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APPENDIX J.

TO

SECOND REPORT OF COMMITTEE

UPON

THE FEVER HOSPITAL

AND

MUNICIPAL IMPROVEMENTS:

CONTAINING

CORRESPONDENCE RESPECTING THE DRAINING OF THE SALT WATER LAKE AND THE CONTINUING OF THE CANAL NAVIGATION THROUGH THE SALT WATER LAKE TO HOSEINABAD AND KOOLNA, AS PROPOSED BY THE LATE MAJOR SCHALCH, AND TO A CANAL TO CHANNEL CREEK, ETC.

CALCUTTA:
Bishop's College Press.
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APPENDIX (J)

No. I.

Queries put by the Committee upon the Fever Hospital and Municipal Improvements to Capt. A. H. E. Boileau, Engineers, Superintendent of Canals, &c., and his Answers thereto.

No. I. Capt. A. H. E. Boileau, (Engineers,) 11th Feb. 1841.

12th January, 1841.

Q. 1. Your attention is requested to the Minute of the Governor General of India, Lord William Bentinck, of date the 2d February, 1830. Appendix G. page 1.

In Para. 4 of that Minute mention is made of a New Circular Canal then executing. It is understood that this Canal is now executed and in use—its two extremities being as therein described; and the Communication with the Sea, through the Entally Canal and by a Navigable Channel passing through the Salt Water Lake, being such also. Be so good as to say whether the circumstances stated in this Para. are, in your opinion, correctly stated, and if in any, what particulars they are incorrectly stated.

A. This Canal has been executed nearly in the manner described; the Entalee Canal is however a mere *Cul de Sac,* and forms no part of the general line of Navigation between the Salt Water Lake and the Hooghly, which comprises only the Baliaghata and New Circular Canal. The Baliaghata Canal, which is about 70 feet wide, commences at the West edge of the Salt Water Lake, and runs 9000 feet, or $1\frac{3}{4}$ mile, Westward to its junction with the Circular and Entalee Canals. The latter Canal is 66 feet wide at the waterline, running 5000 feet, or nearly a mile from the West end of the Baliaghata Canal to within a few yards of the Circular Road, where it terminates. The Circular Canal commences at the junction of the Baliaghata and Entalee Canals, running first Northward and then Westward until it falls into the River Hooghly immediately South of Cheetpoor. Its length is 19,000 feet, or rather less than $3\frac{3}{4}$ miles, and its width is 72 feet, having a single Lock with a double pair of Gates immediately under the Cheetpoor Bridge.

Q. 2. You will observe upon the Plan inserted opposite page 47, the line of Canal from the Baliaghatta Canal to G, and thence to B, which it is understood Lord William Bentinck proposed for the continuance of the New Circular Canal round the Lake, as mentioned in Para. 5 of the above Minute. Your attention is requested to His Lordship's observations in Para. 9 of the said Minute,—to those of Col. Galloway in Para. 6 of his Minute No. 6 (C.) of App. G. page 46,—to the proposal of Major Schalch relative to the Channel through the Salt Water Lake at page vii. of his Memoir, A. No. I. of App. to App. G.—to the observations of Mr. Blechynden in Para. 5 of his Letter E. 14. of said App. page lxxv. Be so good as to state whether, in your opinion, the carrying a Canal through Dry ground in the direction suggested by His Lordship, would be attended with any, and what, beneficial effects, as compared with a Channel through the Lakes. Appendix G. page 47.

1*st.* In regard to the Navigation.

2*nd.* In regard to the question of Draining the Marsh.

No. I.
Capt. A. H. E. Boileau, (Engineers,) 11th Feb. 1841.

3rd. In regard to the Warping up of the Marsh, if that measure should be resolved on.

4th. In regard to the Drainage of Calcutta—and be pleased to state your reasons for the opinion you have formed on these several matters?

A. The Circular Canal has been excavated without any of the evils anticipated by Mr. Blechynden.

I do not anticipate any benefit from such a Canal in any degree commensurate with its expense, though it would facilitate the bringing of all bulky articles of Country Produce into the populous Suburbs of Ballygunge, &c. But a continuation of the Circular Canal into Tolly's Nullah would answer this purpose much better.

The effect would be to substitute a circuitous for a direct line.

No advantage would be gained, as there is a sufficiently deep Cut (the Lake Channel) already in existence; a trifling benefit might result—but at an enormous outlay, as the present Lake Channel would be entirely sacrificed if a Canal round the margin of the Lake were to be substituted for it.

Lord William Bentinck himself says in Para. 12 of his Minute, Ap. G. p. 4. that the Drainage will not be affected.

Q. 3. Are you of opinion that, for the purposes of the Navigation required, as well for the supply of Calcutta by Water communication with Tarda Nulla, as for a water communication between Tarda Nulla and the River Hoogley above Calcutta, reference being had to the communication in the Dry Season with the Ganges through the Sundurbunds, the present Channel through the Salt Water Lake from the end of the Entally Canal to Tarda Nulla is sufficient in depth and breadth, and other facilities required for Canal Navigation, particularly Towing Paths and Roads communicating with its Banks? Whether if the Channel is, in your opinion, defective in any of these, or in other respects, it might be rendered by improvements, which you can suggest, adequate to the purposes of such Navigation, and preferable, either in point of convenience and eligibility, or of expense, to a new Canal cut through Dry ground? If so, be so good as to state what those improvements are, and what would be the probable expense of them?

A. The number of boats paying Toll, which entered the Canal from the Salt Water Lake in the year 1839 was,	40,625
And in A. D. 1840,	62,915
The number which entered the Circular Canal from the River Hooghly in the year 1839 was,	10,828
And in A. D. 1840,	16,955
Hence the entire number of boats frequenting this line of navigation, exclusive of Canoes and other small boats in the year 1839, was,	51,453
And in 1840,	79,870
Average per Annum,	65,662
Taking the six months ending 31st August in each year, when it appears that there is the smallest quantity of Traffic on the Canals, the total number of boats paying toll in six months of 1839, is	23,397
1840,	31,385
Average of the half year,	27,391

Leaving an Average for the half year, including the Winter months (when the Nuddea Rivers are shut) amounting to 38,271 Boats. The traffic during the Winter half of the year is therefore, to that of the other half, as 14 to 10 nearly: so that whatever accommodation may be sufficient for boats during the Rainy Season, would require to be increased nearly one-half more in the cold weather, as far as the traffic in the immediate neighbourhood of Calcutta goes.

No. I.
Capt. A. H. E. Boileau, (Engineers,) 11th Feb. 1841.

The present accommodation for Boats is not quite sufficient for the great number of Boats which come to discharge their cargoes within these Canals, but it seems to be sufficient for those which are merely in transit.

The Towing Paths of the Salt Lake Channel scarcely deserve the name, and might be very much improved if the Superintendent of Canals had leisure to turn his attention to them. The Towing Paths of the Baliaghatta, the Entally, and the Circular Canals are excellent, and they have Pukka roads along their banks for about five miles, which might be advantageously extended throughout their whole length.

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Appendix H.
page. 566.

The improvement, or rather perfecting, of the present rude Towing Path along the Lake Channel by converting it into a Carriage road for five miles, between Baliaghata and Bamunghata, might perhaps cost 40,000 Rupees, or 8,000 per mile. The construction of a Pukka Road along the South bank of the Baliaghata Canal, 15 feet broad and 11,000 feet long, from the Koolia Bridge to the Baliaghata Dock, is calculated in my Estimate No. 8, dated 21st August 1839, to cost Co's. Rs. 8,507-13-0, but this expense has not been sanctioned by Government.

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page. 196.

A Pukka road, about 3,500 feet long, is now in progress along the North Bank of the Baliaghata Canal, at an expense of Co's. Rupees 2,152-1-0 (vide my Estimate No. 2, dated 1st October 1840); but to render it as efficient as possible it should be carried a mile farther, so as to reach the Salt Lake—the cost of which ought not to exceed 3,500 Rupees more.

4 *Q.* ~~3~~. Has this Channel been ever deepened agreeably to Major Schalch's proposal, and do you know at what expense—and if you are of opinion that it now is, or might be rendered by such improvements as you shall suggest, adequate to the purposes of such navigation? Are you of opinion that in its present state, or after the execution of such improvements, it would oppose any obstacle to the Drainage of the Marsh, or to the Warping it up, if that measure should be resolved on?

A. Not that I am aware of.

The widening it by taking out Earth for bunded Roads would I think be enough.

It would form no great obstacle either to the Draining or Warping—though it would add to the expense of them, because some provision must be made for keeping the Lake Channel navigable at all times, during either of these processes.

Municipal Committee's Report, pages 40 to 56 inclusive.

Q. 5. Your attention is requested to the line of the main Drain and Sewer projected by Major Forbes for the Drainage and Cleansing of Calcutta by carrying the water and filth into the Salt Water Lake, which is described in the first Report of the Committee, and is laid down by Captain Fitzgerald on Captain Prinsep's Map of the Suburbs of Calcutta in Appendix G. marked No. I. (B.) and on the small sheet Map of Calcutta inserted opposite page 180½ of Appendix D. Are you of opinion that any facility, or the contrary, would be offered to the operation of such projected Main Drain by the formation of Lord William Bentinck's proposed Canal,—or, on the other hand, by the continuance and improvement of the present Channel?

A. The improvement of the present Lake Channel by bunded roads would bring higher tides from the Soondurbuns to Calcutta, and would lessen the fall toward the Lake Level, and thereby affect the Drainage, but in a trifling degree. The same effect might be produced by Lord William Bentinck's proposed Canal.

Q. 6. Your attention is requested to the small Canal projected by Major Forbes to ascend from the Salt Water Lake through the centre of the Town—being in part the same, and for the rest following the same line with the said Main Drain and Sewers,

No. I.
Capt. A. H. E. Boileau, (Engineers,) 11th Feb. 1841.

described in the former Report of the Committee. Are you of opinion that the reception of the small boats called *Saltees* there mentioned, would materially lessen the crowding of boats in the Entally and Circular Canals?

A. The number of Canoes paying Toll at the subsiding station of Russa, on Tolly's Nullah, in 1840, was 25,420, averaging 2,118 per mensem; but I do not find that they impede the passage of large boats on that line of Navigation, nor do the Canoes on the Lake Channel appear to offer the least obstruction in that quarter.

I think not, but that if a new Canal were opened into the heart of the Town, *Saltees* would increase in number, and ply on it, without much lessening the number now plying in the Circular Canal?

Q. 7. Is the crowding of boats in the Entally and Circular Canals such at present, as materially to impede the free Navigation of these Canals; and if so, what measures would you suggest for remedying this inconvenience—and what amount of expense would it be necessary, in your opinion, to incur for this purpose?

A. Great obstructions are experienced from the numbers of boats which lie in the Canal to discharge their cargoes, which might be in part prevented by widening the Baliaghata Canal, or by excavating small Docks, here and there, as the large Docks at Baliaghata are too far off for the Merchants to make much use of them.

As a very important, and perhaps most efficient remedy, however, I would propose that the Circular Canal be continued behind Entalee and Ballygunge into Tolly's Nullah at Bhowaneepoor, which would form a new line of navigation $3\frac{3}{4}$ miles long, and would cost perhaps four Lakhs of Rupees, including all the necessary Bridges, and a large Lock—but exclusive of the Purchase of Ground.

Q. 8. Your attention is requested to Lord William Bentinck's Minute above mentioned. Para. 11—to Captain Prinsep's Memorandum and Diagram therein referred to—to the Letter of Col. Faithfull, Secretary to the Select Committee E 7. of App. to App. G. page lxi.—to Mr. Phillips's Paper, Para. 13, E. 21, *a.* page xciv. of said App.—to Mr. Cardew's Paper, page 13 and 14, E. 41, page cxlviii. of said App. from which it appears that from long before, and down to Lord William Bentinck's time, the state of Tolly's Nulla was the subject of great complaint. Have any and what measures been since taken for the removal of those causes of complaint, or is the crowding of the Boats and the difficulty of Navigation in Tolly's Nullah still such as materially to obstruct, or in any degree to endanger the communication; and if so, what measures would you suggest for remedying this inconvenience—and what amount of expense would it, in your opinion, be necessary to incur for this purpose?

A. Has nothing to do with the matter, as it refers to the deepening of Tolly's Nullah previous to the excavation of the Lake Channel.

Sensible paper. [Mr. Phillip's]

Cannot find this paper. [Mr. Cardew's.]

Tolly's Nullah Sand Banks have been dug out by me to a small extent—in addition to the former deepenings; and more work is in progress—but many other parts of this line still require to be cleared out.

The opening of the Circular Canal has taken away so much of the traffic from Tolly's Nullah that the latter is now only half of the former, though it is still traversed by 31,315 Boats per annum.

The number of Boats which paid Toll in 1839 being, ...	26,020
And in 1840	36,610
Exclusive of	25,420 Canoes.

It would, I think, be highly beneficial to open a broad Towing Path, or even a Carriage Road, along one side of Tolly's Nullah all the way from the Hooghly to the Soondurbuns, or to Pauspota Toll station, say 11 miles long, but the expense would be great about Bhowaneepoor, Kalleeghat, and Tolly Gunge, where the banks are thickly inhabited; and the expense of this work could not easily be estimated without a particular Survey being made of both banks.

No. I. Capt. A. H. E. Boileau, (Engineers,) 11th Feb. 1841.

Q. 9. Are there any other, and what other, undertakings which you would recommend for the improvement of the communication by water of Calcutta on one hand, and the Hoogley above Calcutta, on the other, through the Sundurbunds with the lower part of the Ganges and the Eastern Provinces; and if so, be pleased to state them, and your opinion in regard to the probable amount of the expense?

A. The cutting a Canal from Entalee to Bhowaneepoor has already been suggested; and another Canal ought to be dug through Mr. Heatley's lands near the Booree Gang —shortening the navigation of the Mofussil Canals two tides, or perhaps 24 hours— the distance would be 1½ mile, and the probable expense 30,000 Rupees.

A Pukka Road along the South bank of the Baliaghata Canal, already mentioned vide Query 3, would probably add to the usefulness of the new Docks excavated at Baliaghata.

Compared,
R. R. D.
11th February, 1841.

A. H. E. BOILEAU,
Capt. Engineers.

No. II.

Queries put by the Municipal Committee to Captain A. H. E. Boileau, *Engineers, Superintendent of the Calcutta Canals, &c. and his Answers thereto.*

19th February, 1841.

No. II. Capt. A. H. E. Boileau, (Engineers,) 4th March, 1841.

Q. 1. Do you see any reason to doubt the practicability of completely Draining the Marshes called the Salt-Water Lakes? Do you think this can be accomplished by an opening between these Lakes and the River Hoogley, and also by openings into a Canal which should communicate with the Sea by Tardah Nulla—and if you think it practicable by both means, which would you recommend for adoption; or would you advise the opening of both communications, to be employed at different times of the year, according to the respective levels, as these are varied at different Seasons? If you advise a Drain opening into the River Hoogley—at what point do you think it ought to enter the River? and what do you think would be the probable expense of such works respectively?

A. I do not see any reason to doubt the practicability of Draining the Salt-Water Lakes, though I do not think the execution of it to be advisable.

An opening between these Lakes and the River Hooghly would hardly answer the purpose of Draining them—the lowest Neap flood in the River (in September) being 2 feet above the highest Lake Tides; but the Lake Drainage could be effected by the Soondurbun Outlets.

No. II. Capt. A. H. E. Boileau, (Engineers,) 4th March, 1841.

Being altogether opposed to the Drainage of the Lake, I would not recommend the attempt to be made either way—but should it be undertaken at all, I think that it could best be done in the direction of the Tardah Nullah : the general surface slope of the Lake is already in that direction, and the attempt to effect a Drainage into the Hooghly would invert the line of slope.

The most convenient point for all communications between the Salt-Water Lakes and the River Hooghly appears to be between Cheetpoor and Cossipoor.

The framing an Estimate for this work will occupy more time than I can spare for it at present.

Q. 2. What effect do you think such Drains, more particularly a Drain from these Lakes into the Hoogley, would have upon the Drainage of Calcutta, supposing the Plan of Drainage proposed by Major Forbes, and adopted by this Committee in its former Report, were carried into execution ?

A. I do not think that such a Drain would have any particular effect on the run of water from the Town Sewer either in a beneficial way or otherwise ; nor would it at all interfere with the Plan of Drainage for the Streets by an internal City Canal, as proposed by Major Forbes.

Q. 3. Your attention is requested to Para 10, of Lord William Bentinck's Minute above referred to—to Para. 6 of Col. Galloway's Minute, page 46 of Appendix (G.)—and to the Letter from the Military Board to the Right Honorable Lord Auckland, of date 29th August 1837,

Appendix H. page

Are you of opinion that if a Canal were cut in the direction proposed by Lord William Bentinck, and with the sides so raised, the necessity of Lock Gates at the mouth of the Circular Canal, where it takes its departure from the Hoogley, would be superseded? and are you of opinion that the dispensing with such Lock Gates, if it might be done with safety, would be attended with advantage or the reverse, and in what respects ?

A. Captain T. Prinsep states the probable effect of a close channel through the Lake to Calcutta, would be to raise the waters about 1½ feet in the farther extremity of the Circular Canal at Cheetpoor, which difference is so small, when compared with the variations of the tide in the Hooghly at the other side of the Lock Gates, that I do not think the latter could be safely dispensed with.

The waters of the River Hooghly are carefully excluded from the Canal, except when their current is purposely admitted, in order to scour out the Silt deposited by the Town Drains, and on these occasions the Navigation of the Canal is considerably impeded even by this moderate current : were there to be no Lock Gates at Cheetpoor, the banks of the Circular Canal would be injured, and very many of the boats which traverse it, would be wrecked, as occasionally happens even at present, when so much command is obtained over the waters of the Hooghly by means of these Lock Gates. The traffic on the Canals would I think, be much lessened, and the Trade seriously injured by any attempt to do away with the Locks.

Q. 4. Your attention is requested to Paragraphs 8, 10, and 14 of Lord William Bentinck's Minute—to Captain Prinsep's Memorandum, No. I. (G.) page 17 of Appendix (G.) and Schedules No. I. (G. 1) and (G. 2,) thereto annexed—to Captain Prinsep's Memoranda, No. I. (H.) page 25—to Sir Thomas Anbury's Minute, No. V. page 30—to the Answers returned to the Military Board by their Committee, No. 6, (B.) page 38—to Captain Thomson's Description of the Ground lying South-eastward from Calcutta, No. VI. (B. 1,) page 39, and Estimate No. VI. (B. 2,) and Plans there referred to—to the Minute of Lieut. Col.

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Galloway, No. VI. page 44, and the "Plan showing the means proposed by Lieut. Col. Galloway and the Committee for Draining the Salt-Water Lakes"—to the Minute of Sir Thos. Anbury, No. VI. (D.) page 48. Are you of opinion that the Warping up of the Salt-Water Lakes is practicable so as to render the large Surface of these Lakes dry for the purpose of Cultivation, and free from the generation of Marsh Miasmata—and if you are of this opinion, do you think that the so doing would in any respect endanger the Drainage of Calcutta, or in any respect which may not be obviated by an improved System of Drainage?

A. I am of opinion that the Warping up of the Salt Lakes is practicable so as to bring their entire Surface under Cultivation; which measure would I think be highly beneficial in many ways, and I would strongly advocate the adoption of this measure in preference to making any attempt at Draining them.

Though temporary inconvenience might be sustained during the progress of such a work, by the drying of the mud deposited in the present site of the Lake in the course of season, yet I do not think that the neighbourhood would even at those times be at all more unhealthy than it is at present; the atmosphere in the immediate vicinity of the Lakes being now very pestilential, and several of my people have died from its effects.

After the work of Warping shall be completed, and the surface of the Lakes raised two feet above their present level, and brought under cultivation, I do not suppose that their neighbourhood would then be nearly so unhealthy as it is at present. A large area which is now nearly worthless as well as noxious, would be brought under cultivation, and become most valuable arable land, at a cost far below the returns that may be expected, should this great work be carried into execution.

It would not, in my opinion, in any way endanger nor interfere with the Drainage of the City beyond the trifling difference of level already adverted to in my answer to Question 3, which need scarcely be taken into consideration.

Q. 5. The Committee observe that Captain Prinsep states that the surface of these Lakes is naturally divided into three compartments—the Western, Eastern, and Southern,—and he proposes to commence with the first of these. Do you agree with him and Col. Sir Thos. Anbury on the propriety of thus commencing the Work, and are you of opinion that it would be necessary or expedient to form Bunds in the direction suggested by Sir Thos. Anbury, or in any, or what other direction, or what other expedient would you propose for stopping the current of the coloured water of the Hoogley so as to insure a deposit, if it shall be deemed advisable to bring the River water for silting into the Lakes? and are you of opinion that the work ought to proceed progressively in the manner proposed by Sir Thos. Anbury?

A. I agree with Capt. Prinsep in his proposal to commence the process of Warping upon that portion of the Salt Lakes nearest to Dum-Dum, and of course concur with Sir Thos. Anbury, as far as his plans coincide with those of Captain Prinsep's: but I do not think the Lakes ought to be drained previous to their being Silted up, as appears to be recommended by the Chief Engineer.

Without a more intimate acquaintance with the localities of the Lake than I now possess, it would be difficult to say which would be the best lines for the required embankments; but whatever particular distribution of bunds might be adopted, it would I think be expedient that the banks of the present Lake Channel should form part of the line of embankment, as proposed by Colonel Galloway and others.

It would I believe be the best way to execute the work progressively, and to see that one portion of the Lake is fairly silted up before the turbid waters of the Hooghly are turned upon any other portion of it.

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Q. 6. Are you of opinion with Sir Thos. Anbury that there would not be any difficulty in bringing the coloured water of the Hoogley to the Western Lake through the Circular Canal so as to afford sufficient Deposit for Warping up the Lake, and this without any prejudicial effect upon the Navigation of the Canal, which might not be guarded against or obviated if found to exist; or do you think that a separate Feeder from the Hoogley, above the mouth of the Circular Canal, direct into the upper part of the Lakes ought to be formed for the sole purpose of silting up these Lakes? At what distance above the Lock at Chitpore Bridge, do you think such Feeder Canal ought to take its departure from the Hoogley—of what dimensions ought such Canal to be—and of what velocity—of what depth at its mouth below the surface of the River at high and low water during the Freshes and the dry weather can such Cut in your opinion be made in such way as to secure it from accident and from endangering the vicinity—and if so by what means—and what do you think would be the expense of such Canal provided with all such necessary means of safety and efficiency? Are you of opinion that the opening of such Canal would be attended with any more difficulty or danger than attended the opening of the River into the Circular Canal?

A. It would be scarcely practicable to use the Circular Canal in any way as a Feeder of muddy water to the Lake, without doing serious injury to the Canal Banks, and materially obstructing the navigation, by which great inconvenience would be occasioned to the Public, and a material loss of Revenue to the Government in the Toll Department, beside the increased expense of keeping the Canal in repair.

It has been suggested that a Feeder to the Lake should be dug from the Circular Canal East of the Bridge on the road to Dum-Dum, which would save more than a mile of cutting, and do away with the necessity of building two or three large Bridges; but the injury which would be done to the Canal and to the Boats all along one of its most crowded portions would forbid the adoption of this Scheme.

A separate Cut should, in my opinion, be made about 3,600 feet north of the Cheetpoor Bridge, so as to intersect the Barrackpoor road above the Telegraph Tower, by which one very large Bridge could be dispensed with, and no injury would be done to the estates of Baboos Dwarkanath Tagore and Ashootos Day, for which heavy compensation might otherwise be claimable; and this line would bring the Feeder through ground which is now of comparatively small value, but which might eventually be greatly improved by turning the Feeder (after the process of warping should be completed) into a navigable Canal for small Boats plying between Kasheepoor [Cossipoor] Belgachia, Kishunpoor, and Bamunghata, to which place an open channel should be preserved while the Lakes were being silted up, so as to preserve a communication between the Tarda Nullah and the new Canal from Cossipoor, which would relieve the Baliaghata Canal from much of its present crowding, as it is barely large enough for the great quantity of traffic on it.

With respect to the dimensions of the new Feeder, the section of 200 square feet recommended by Captain Prinsep, seems to be quite enough for the supply of muddy water, but it might be increased to 300 feet with advantage (i. e. 68 feet wide at the water line, 32 feet width at bottom, and 6 feet depth of water) should it be determined to convert it eventually into a navigable Canal— and I see no reason to differ from Captain Prinsep's suggestions that the current should not be allowed to exceed 2¼ @ 2½ miles per hour.

The highest Lake tide in August, and the highest ebb in the Hooghly for the same month, being exactly identical in height, Captain Prinsep has assumed this point, or 2 feet above zero, as the best level for the floor of the Feeder, at its Hooghly mouth, and zero (that is the ordinary flood tide level at Baliaghata), or perhaps one foot below this level for the floor at the Lake mouth: but a level nearly 6 feet lower than this would have to be assumed for the Feeder, if converted into a Canal for Boats.

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Sluices might easily be constructed so as to do away with all danger of inundation, and would command the current admitted from the Hooghly so as to prevent the banks of the Feeder from being injured.

Captain Prinsep's Estimate, Appendix G. No. 1, (G. 1.) of the Municipal Committee's Report will give a very good idea of the expense attending the execution of such a Feeder as he proposed; and the enlarged one recommended by me would probably cost rather more than double his Estimate, or in round numbers 3,00,000 Rupees.

Q. 7. Are you of opinion that the Salt Water being embanked out, and alluvion-charged water admitted into the Lakes, Sluices would be necessary for the discharge at ebb tide of such water, or of Rain water—and if so, be pleased to state how many—where placed—and at what expense.

A. I think that the Bunds may be made with overfalls in such a manner as to supercede the necessity for constructing Sluices.

Q. 8. The Committee observe that the Committee named by the Military Board on the subject of Draining the Salt-Water Lake, reported their opinion that the alluvion-charged water should be admitted by the Canal, meaning it is supposed the Circular Canal, and also by a Feeder joining the Hoogley and the upper end of the Lake, adopting herein, as it should seem, a suggestion of Sir Thomas Anburey's. Are you of opinion that this double source of supply of alluvion-charged water would be advantageous, or the contrary, to the desired Warping of the Lakes,—or if so, injurious to the Navigation?

A. I am of opinion that the supply of alluvion to the Salt Lakes, should be entirely drawn from a separate Feeder, as the making use of the Circular Canal for this purpose would be injurious both to the Canal and to the Boats which navigate it.

Q. 9. The said Military Board Committee also reported that the Drainage of Calcutta to the Northward of Durrumtollah would not be affected, and that of the ground to the Southward of that Street would be much improved by the Works they proposed. Are you of opinion that this would be so, independent of the adoption of the System of Drainage proposed by Major Forbes, or some similar system.

A. I concur with the Military Board's Committee in thinking that the Drainage of the Northern part of the City would not be injuriously affected by the construction of the proposed Works, and that the Drainage of the Southern Suburbs would be improved by them: but I also consider that the improvement of the Drainage in the latter portion of the Town, would be effected in a far higher degree by the excavation of a Canal between Tolly's Nullah and the Entalee Canal, as lately recommended by me; and I think that the Drainage might be perfected without following the Plan recommended by Major Forbes, which provides for giving double the present fall for the Drains, whereas I consider that there is quite fall enough at present for carrying off all the Rain and other water, if the slopes of the Drains were properly managed.

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Q. 10. The Committee observe that the Honble. the Court of Directors, in their Dispatch to the Government of India, under date the 18th January 1837 (No. 2 of 1837) para. 4, referring to the Dispatch of the Government of India under date 17th of February 1834 remark, that great inconvenience appears to have arisen from the accumulation of Silt deposited in the Canal by the Calcutta Drains, which the Honble. Court state to be an undeniable evil (para. 6); that it appears that the conduits which discharge the Drainage of the City into the Canal, were found to afford too easy a vent for the Drain-water which carries a large quantity of suspended matter into the Circular Canal; and (para. 7) that

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this was causing considerable injury to the Canal, and required the application of an immediate remedy. In Para. 19 the Honble. Court observe that there can be little doubt that after the communication with the Hoogley has been completed the alternate flow of water between that River and the Salt-Water Lake, will have some effect in clearing the accumulation at the mouths of the Drains—but they state that they are not however without their apprehensions that this is an evil which will not be remedied at so easy a rate as the Government of India anticipated, and that the most economical mode suggested as the remedy: viz., the throwing a bund across the Canal and removing the deposit by means of hand labour must materially increase the annual expenditure on account of the Canal. Are you of opinion that this view taken by the Honble. the Court of Directors is a correct one; and if so, that it would be of importance to the keeping the Canal clear from the accumulation of Silt and filth in its bottom, and to the keeping down the annual expenditure on account of the Canal, if all the Drains and Sewers of Calcutta, when these latter shall be constructed, were so formed as to empty themselves into one main Sewer or Drain, which should be discharged into the Salt-Water Lake, below the point of communication of the Circular Canal with that Lake, agreeably to Major Forbes's, or some similar Plan?

A. The evil arising from the deposit of Silt in the Circular Canal owing to the too easy vent afforded by the mouths of the Drains, appears to have been partially remedied by low walls built across the mouths of the principal Sewers, by which their undue slope was corrected, and much of the Silt retained upon the floors of the Drains at the back of these low walls.

Much of the Silt however still finds its way into the Circular Canal, whence it is scoured into the Baliaghata Canal by the admission of a current from the Hooghly through the Cheetpoor Lock Gates: but after this current meets the Flood tide from the Soondurbuns it appears that a considerable portion of Silt is checked in its progress toward the Lake Channel, and being brought back by the flow of the tide is ultimately deposited in the Entalee Canal, which acts as a kind of large mud-trap, nearly a mile long, and requires to be dug out by hand labour every four or five years.

This operation has just been completed by me, about 7,22,065 cubic feet of mud having been excavated from the bed of the Canal; and the Honorable the Chairman of the Municipal Committee has had an opportunity of witnessing the manner in which this work is done. The estimated expense was only Rs. 4,528-10-6, and this sum will more than cover the actual cost—so that the annual expense of clearing the Silt from this Canal, may be taken in round numbers at 1,000 Rupees, and the emptying of the Dhurmtollah Cess-pool (which is contiguous to it) at 500 Rupees more.

The total expense, per annum, for keeping this part of the Canals clean, is, therefore, about 1,500 Rs. per annum, and I have not, to the best of my recollection, expended even a single rupee in keeping clear either the Circular or Baliaghata Canal during the two years that they have been under my charge. The Baliaghata Canal will however require to be cleared out by and bye, and supposing that the above total of 1,500 Rupees per annum to be doubled by this expected operation, the aggregate expense for keeping the Canals clear from mud would be only 3,000 Rupees a year,—whereas the annual income derived from the Tolls on their line is upwards of 70,000 Rupees.

The Municipal Committee may, I think, fearlessly adopt any System of Drainage that may seem best to them for removing the Scourings of the City, without anxiety as to where the mud will ultimately be deposited; the Canal Department being quite competent to get rid of all the Silt that may be discharged from Drains and Sewers properly constructed, for which purpose the Conservancy Department of Calcutta and the Superintendent of Canals ought always to act in concert, and to be in amicable communication with each other.

With proper precautions (particularly by the construction of large Cess-pools at the mouth of the other principal Sewers, similar to that one at the mouth of the Dhurmtollah Drain) very little mud would find its way into the Canals at all, but the expense of emptying these Cess-pools would fall rather heavily on the Conservancy Department, though such a system would after all be infinitely less expensive than the Plan proposed by Major Forbes.

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Q. 11. The Honourable Court in the Dispatch above mentioned (para. 2) observe that of 3,50,000 rupees authorized for the operations of the Circular Canal only 2,02,155 rupees had been expended, and (para. 22) they declare that the expenditure that is absolutely necessary to render practically useful such works as have already received their approval is unavoidable. Are you of opinion as an Engineer, that the providing, if possible, for the discharge of the filth, and Mud and Silt, with which the Drains of Calcutta are charged, without depositing them in the Circular Canal, is necessary—or would be highly conducive to render that work practically useful to the extent to which it must have been intended to benefit the community, and the Revenues of the Government?

A. I have on a former occasion laid before the Municipal Committee an Abstract of the Sums expended in completing the Circular Canal, with its Lock Gates, Bridges, Roads, and Drains, which Memorandum is repeated here for convenience of reference.

Mr. James Prinsep's Memorandum Book C.—ID. April 1834.

Amount actually expended on Canal (Circular, 19,000 feet long), ..				1,22,404	10	8¼
5 Bridges (Baliaghata, Norkooldanga, Maniktola, Dum-Dum, and Barrackpoor), ...	72,856	14	3½			
1 Unfinished Bridge at Ooltadanga, ...	5,953	12	7			
Raising roadway to Chitpore Bridge, ...	1,166	15	1½			
				79,977	10	0
58 Drains, ...				20,345	7	5¼
Road (about 19000+4000=23,000 feet long,)				44,128	6	10
				2,66,856	2	11½
Single Lock (60 feet long and 22¾ @ 24 feet wide,)				61,098	7	11
Total Sicca Rupees, ...				*3,27,954	10	10½

I have already suggested that Cess-pools might be constructed at or near the debouchures of the principal Drains to catch the mud, and to allow only the water from the Town to run into the Canals, nor do I think that any other provision need be made by the Town Conservancy, for getting rid of such mud or silt as might after all find its way into the Canal. This could I think be cleared away by the Superintendent of Canals without materially interrupting the traffic, or incurring any further outlay than 3000 @ 4000 rupees per annum for the Northern portion of the City, and perhaps as much more for the Southern portion, should the Circular Canal be continued to Tolly's Nullah.

Q. 12. Have you had any opportunity of becoming acquainted, from report or otherwise, with the effects of the accumulation of filth and silt in the Entally Canal upon

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* If to this sum (Rs. 3,27,954-10-10½) be added Rs. 9,56,650-2-4† for the Purchase of Ground, the total cost of forming the Circular Canal will appear to amount to Rs. 12,86,604-5-3½—this however is not borne out by the Statements‡ annexed to a Report by the Military Board to the Governor of Bengal, dated 27th October, 1835, which state the Total cost of constructing the Circular Canal up to 1st May 1835, to be Rs. 14,80,488-0-1⅓—Again, if to the most correct of the above sums the Total cost of constructing the Soondurbun Canals up to 1st May 1835, viz. Rs. 3,70,665-1-8⅔ be added, it will exhibit the whole cost of executing, so far as it has been executed, viz. to the Juboona or Ishamuttee River, the late Major Schalch's Plan.§—J. M.

* Proceedings 17th November, 1835, No. 2.

† Proceedings 17th November, 1835, No. 1.

‡ Proceedings 1st November, 1836, No. 13 and 15.

§ Appendix to Appendix G. page 1 and xxvii xl. ccxxii.

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the health of the inhabitants of its banks ? If so, be pleased to state what, according to your information, those effects have been ?

A. I have never had any complaints made to me of the insalubrity of the Entalee Canal, nor do I observe that the people who inhabit its banks are less healthy than those who reside in other parts of Calcutta ; but Mr. Blaquiere, who has had the experience of very many years, has given evidence of an opposite nature, which ought to have more weight than mine.

Q. 13. Have you had occasion to observe the state of health, and appearance in point of health, of the inhabitants of the borders or of any habitable parts of the interior of the Marsh called the Salt-Water Lake ? and if so, be pleased to state the result of your observations in these respects. Be pleased also to state the description of the Marsh in the close neighbourhood, or generally to the windward of such habitations—whether the waters are deep enough always to cover the whole ground, and to what depth, or the ground is only partially so covered,—much of it which is not actually covered with water being damp, or but little raised above the water, or the surface is generally subject to be covered, and left dry as the tide flows and recedes ?

A. There has been great sickness and mortality both in my Toll-collecting establishment at the station of Dhapa Monpoor on the Western margin of the Salt-Water Lakes, and also among the people employed by me in driving piles along the South bank of the Baliaghata Canal. The mortality among the former I attribute entirely to local causes, as my people appeared to have sunk under endemic disease arising from Marsh Miasmata, but the deaths on the Baliaghata Canal have, I believe, been caused by Cholera Morbus, or some epidemic disease, and not from local insalubrity.

I am not sufficiently familiar with the Salt Lakes to describe their appearance accurately, but as far as I have seen them, the surface seems to be alternately wet, and dry, according to the state of the tide—except in such portions as are kept altogether dry (during the cold and hot Seasons only) by means of embankments.

Q. 14. Are you of opinion that before commencing the operation of Warping, it is necessary to Drain that part of the Lakes which it is proposed to Warp—and could such drainage be so speedily and effectually completed as to avoid the powerful generation of Marsh Miasmata which has been known generally to attend the incipient and progressive drainage of extensive marsh ?

A. I do not think that it would be advisable, on any account, to attempt the Drainage of the Salt Lakes previously to their being Warped up ; and I greatly fear that injurious results would arise from undertaking any such operation, by which so large a surface of Pestilential soil, and Miasmatiferous matter would be exposed, to the great detriment of every person living in its neighbourhood, or to leeward of it.

COMPARED,
(Signed) HURLOLL.

A. H. E. BOILEAU,
Capt. Engineers.

No. III.

COMMITTEE ROOM, TOWN HALL,

Thursday, 18*th* *March,* 1841.

Mr. A. DYSON, *Examined.*

No. III.
Mr. A. Dyson,
18th March, 1841.

Q. 1. We understand you are the Overseer of the Intallee Suburb?

A. Yes,—for twenty-four years. I was two years in Balleygunge.

Q. 2. How long have you resided in Intallee? and what has been the state of your health during your residence there?

A. Twenty-four years. I have never been sick but once, and that was on the occasion I was attacked with a Jungle Fever whilst superintending the repairs of a cutcha road, close to the Salt Water Lake in the year 1819.

Q. 3. How far is your residence from the Intallee Canal? Is it in an open space?

A. About one thousand yards. It is tolerably open round my house; but there are many trees in all the gardens of Intallee.

Q. 4. Are you much acquainted with Calcutta?

A. Not much with Calcutta; my duties lead me to the Suburbs, upon the Baunhoogly and Barrackpore roads.

Q. 5. Can you form an opinion whether Calcutta is more healthy than Intallee?

A. I think Intallee is the most healthy.

Q. 6. Can you form an opinion of the state of health of the Native inhabitants of Intallee? And what do you think the most frequent Diseases?

A. I think the state of health of the Native Inhabitants in the Western parts of Intallee, is superior to that of the Native Inhabitants of Calcutta.—Cholera, Dysentery, and other bowel complaints, also Fevers and Spleen, are the most frequent Diseases.—I have treated many cases of Cholera. No one that I have treated has died. I give to an adult forty drops of Spirits of Ammonia and forty drops of Laudanum, mixed with two spoonfulls of water.

Q. 7. Have you noticed many cases of Intermittent Fever, and at what Season?

A. I have observed many cases of fever with great warmth of body and no cold fits. I have had the misfortune to lose in 1825-26, three sons from Spleen, one thirteen years and ten months, one ten years and nine months, and another eight years and six months—this was at Intallee.

Q. 8. Have you observed heavy fogs in Intallee as compared with those of Calcutta?

A. I cannot say; I never go to Calcutta in the morning. The fogs of the Suburbs are heavy.

Q. 9. Have you observed to what cause that may be attributed?

A. To want of Drainage, dirty tanks, and decayed vegetable matter.

No. III.
Mr. A. Dyson,
18th March, 1841.

Q. 10. How far do you reside from the Salt Water Lake? Have you observed fog come from that quarter?

A. Two miles. I cannot say that I could observe very heavy fogs whilst working down there; but I think the fogs of the Salt Water Lake about the same as those of Intallee. I wish to observe, that there are many Drains in Intallee which are not cleaned out; I have not the men to clean them. I had formerly only one Division under my charge, (Intallee,) I had then 250 Convicts, and could keep the drains quite clean; this was in Mr. Elliott's, and subsequently Mr. Barwell's time. I have at this time in Intallee only seventy Convicts. I have now two Divisions under my charge, which formerly were under two Overseers, each having control over 200 to 250 Convicts. I receive no extra allowance for the extra duty imposed on me.

Q. 11. Do you observe any difference in the healthiness of the inhabitants since the drains have not been kept clean?

A. I have observed a great difference; formerly, in Mr. Elliot's time, there was not so much sickness. All the gardens are now overgrown with jungle, and the roads overhung with trees, which obstruct ventilation. If people were forced to keep their grounds clean, it would be a wholesome regulation.

Q. 12. What do you consider the healthiest period in Intallee?

A. I have experienced it to have been the healthiest in November, December, January, and February. In March, April, and May, it becomes less healthy. In May and June I have had several cases.

Q. 13. Is July, do you think, a healthy month?

A. I find the Convicts become ill in that month. I keep them in the Guard two or three days—beyond that time I send them to the Hospital.

Q. 14. Do many of the Convicts become ill in that month?

A. Yes, I have in that month eight or nine Convicts ill; this continues much the same during the Monsoon, (August and September). In October, not so ill.

Q. 15. Do you recollect any other class of disease which is common in Intallee?

A. No.

Q. 16. Have you many cases of Small-pox; and do many people die of it?

A. Several Convicts have had the Small-pox, but only one of them died of it, and that three or four years ago.

Q. 17. Have you observed any difference in the healthiness of the people who reside on the banks of the Intallee Canal, as compared with those who reside at some distance from it?

A. I am not sensible of any difference. I know several families residing on the banks, but only one of them, viz. the family of Mr. Marks, was formerly, about two years ago, unhealthy.

Q. 18. Do you know if any persons reside near the Salt Water Lake?

A. Mr. Crow is the nearest Christian, who resides the nearest to the Salt Water Lake, and his family is healthy. There are many natives who live close to the Lake. On the western side of it there are three or four villages close to the bank of the Lake, the houses or huts are within a few yards of the bank.

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Mr. A. Dyson,
18th March, 1841.

Q. 19. Do you happen to know the state of health of the people who live there?

A. I do not know any thing of the state of the health of those about there; my duties do not frequently lead me to the vicinity of the Salt Water Lake.

Q. 20. Are you acquainted with the condition of the Natives employed in making mats?

A. No.

Q. 21. What is the depth of water in the Salt Water Lake?

A. I do not know. In the Monsoon the water covers nearly the whole of the Salt Water Lake.

Q. 22. How is Intallee supplied with Drinking water?

A. Chiefly from tanks. There is a tank on the ground belonging to the Intallee Conservancy Committee, the water of which is at present undrinkable on account of the quantity of putrid vegetable matter accumulated in it; but I am now employed in cleaning it out, when it will be available to the public. We have no other public tank.

Q. 23. Is the water of the tanks wholesome?

A. Yes; the Tank of Mr. Beeby, and the Mooteejheel in Moonshee Aumeer's ground, which is close to Mr. Beeby's, and there is another tank, Debnarain Day Baboo's, on the Coomardanga road, about half a mile from the others. There is another on Puddoopooker road, a private tank, but all the people take water from it, as they do also from the other private tanks except in the Hot season, when the owners, from a fear of their tanks becoming dry, prohibit water being taken from their tanks by the poor native inhabitants, which puts them to great inconvenience and distress. There are many private tanks; but I cannot vouch for the goodness of the water which they may contain.

Q. 24. Are you of opinion that the Suburb of Intallee is amply or very scantily supplied with good water for the use, in Drinking and Culinary purposes, of the poorer classes of the native inhabitants?

A. It is very scantily supplied with good water.

Q. 25. Have you witnessed any material suffering by a want of good water?

A. I have amongst my own Convicts. I have been obliged to send them to Debnarain Baboo's tank; but since Mr. Twentyman has rented, on the South of my residence, a spot of ground, on which there is a good tank, I send, with Mr. Twentyman's permission, the Convicts to that tank. There is no supply of proper water for the public; my Convicts have a tank of their own; but the water is not drinkable.

Q. 26. Have you any wells in Intallee?

A. We have wells, but the well water is not good.

Q. 27. Are you acquainted with there being any natural springs of sweet water in the Suburbs?

A. In a jheel I made at Russapagla, I found several springs of sweet water, the jheel is now the jheel of the Russapagla Hospital, which it supplies with water. It is not a tank, but a serpentine piece of water. Bricks were formerly made in the place where the jheel is; I made the jheel, if I recollect right, twenty-four feet deep; it took about three months to make, with about thee hundred and fifty Convicts; it was made in 1817. I think there must have been the course of a river there, for I found fragments of boats, and pieces of soldier's coats with buttons; no figures were on the buttons.

No. III.
Mr. A. Dyson,
18th March, 1841.

Q. 28. In what state generally are the tanks of the Suburbs?

A. The tanks, with a few exceptions, are covered with green slime, and full of grubs and insects.

Q. 29. Can you state whether any process of purification of the water is employed by the inhabitants of Intallee?

A. I cannot say. I drink mine as it comes from the tank.

Q. 30. Do you know the number of the population of Intallee?

A. No.—I cannot say; I took the census once, and gave it to the Magistrate about five or seven years ago.

Q. 31. Are there many Mussulman residents in Intallee as compared with Hindoos?

A. Yes; about three Hindoos to one Mussulman. I cannot speak with certainty.

Q. 32. Where do the Mussulmans bury their dead?

A. They have a Burying ground at Manicktolla; another between Manicktolla and Narcoldanga; a third at Gobra; and a fourth at Bamunbustee, or Cossiabaugaun.

Q. 33. Are the Burying grounds at all offensive?

A. No; I cannot say that they are. I have passed frequently through them, and have never found them to be so.

Q. 34. Where do the poorer Christians bury their dead?

A. There is one Portuguese Burying ground at Boitaconnah; and one on the Arreetollah or North Intallee road; and another at Mirzapoor; and the poorer Christians of other classes occasionally bring their dead to the Scotch Burial ground.

Q. 35. How do the Hindoos dispose of their dead? Are any ever carried to the Salt Water Lake?

A. They carry them down to the River. I am not aware of any ever being carried to the Salt Water Lake.

Q. 36. How is Intallee off in regard to Drainage?

A. The drains run off pretty free when kept clean, which is not always the case.

Q. 37. Could you keep them clean if you had a sufficient establishment?

A. Yes; formerly in Mr. Elliott's and Mr. Barwell's time, they were kept quite clean. I used to take the levels myself, and when in the control of a larger establishment, the drains were kept so clear, that the water ran pleasantly through them.

Q. 38. Is there a sufficient fall towards the Lake to keep the whole of the Suburb of Intallee well drained?

A. Yes, except sometimes when there is a heavy fall of rain for seven or eight days, then the drains are all full; sometimes the Salt Water Lake, during spring tides, is so full. that it choaks all the drains. I have then seen all the low lands about the Lake covered with water, and all the villages about there, surrounded with water.

Q. 39. What effect do you think the Draining the Salt Water Lake would have upon the health of the neighbourhood?

No. III.
Mr. A. Dyson,
18th March, 1841.

A. I think if the Salt Water Lake was drained, that it would make it more healthy after some years—but not immediately, on account of the rotten jungle and weeds. I think if several very large tanks were dug in the bed of the Lake and in the Low Lands about the Lake, and then bunded, and the surplus soil used to raise the ground in the vicinity of those Tanks, it would tend very early to bring the Lake, or a great portion of it, and the Low Lands about the Lake under cultivation.

Mr. Dyson retires.

No. IV.

No. IV.
Captain W. R. Fitzgerald, (Engineers,) 19th May, 1841.

Answers by Capt. W. R. Fitzgerald, (Engineers,) to the Queries marked No. I. and No. II. to which Answers were requested from Capt. A. H. E. Boileau, by the Committee upon the Fever Hospital and Municipal Improvements.—Vide pp. 1 to 12, of this Appendix.

Queries dated the 8th January, 1841.

To the answers given by Capt. Boileau, to the above Queries, I generally concur.

Queries dated the 4th March, 1841.

Q. 1.

A. I do not see any reason to doubt the practicability of Draining the Salt Water Lakes. I agree with Captain Boileau, in thinking it "could best be done in the direction of the Tardah Nullah," and I would not recommend any opening into the Hoogly River for this purpose.

Q. 2.

A. If the Drain in question would answer for draining the Salt Water Lake, I do not think it would have any detrimental effect upon the Drainage of Calcutta.

Q. 3.

A. In agreement with Captain Boileau.

Q. 4.

A. I am of opinion that the Warping up of the Salt Water Lakes, so as to render their surface fit for the purposes of cultivation, is practicable; at the same time the Lakes must be Embanked in order to prevent any admission of the Salt Water from the Sundurbunds spreading over the ground when thus raised. The Draining and Warping of the Lake, would I think, improve the healthiness of the neighbourhood, and would not in any way interfere with the Drainage of the City.

Q. 5.

A. I agree with Captain Prinsep, in thinking it advisable to commence the process of Warping upon the nearest portion of the Lake, and I would construct the Embankments for this purpose with reference to the general Drainage of the Lake—making any intermediate ones that the separate divisions of the Lake might render necessary.

No. IV.
Captain W. R. Fitzgerald, (Engineers,) 19th May, 1841.

Q. 6.

A. In agreement with Captain Boileau.

Q. 7.

A. I am of opinion that Sluices should be constructed in the Embankments for the discharge of Rain and other water admitted into the Lakes. Their number, position, and expense must depend upon circumstances scarcely determinable without a minute examination of the localities.

Q. 8.

A. In agreement with Captain Boileau.

Q. 9.

A. I am of opinion that the Drainage of Calcutta would not be affected either beneficially or otherwise, by the works recommended by the Military Board Committee.

Q. 10.

A. In agreement with Captain Boileau.

Q. 11.

A. Ditto ditto.

Q. 12.

A. Ditto ditto.

Q. 13.

A. I believe the vicinity of the Salt Water Lakes to be considered unhealthy, but I am not able to confirm this opinion by any local knowledge of my own.

Q. 14.

A. I am of opinion, that it would be advisable to Drain the Lakes, even if they are not Warped; and the doing so would, I think, improve the healthiness of that part of the country. If the Warping system is practised, the portion of the Lake under the operation ought, it appears to me, at any rate to be Drained. If any water is allowed to remain, so much the less will be let in, and a proportionate less quantity of alluvion deposited, and the time which the operation would otherwise take, will consequently be prolonged.

W. R. FITZGERALD,
Captain, Engineers.

Fort William,
19*th May* 1841.

No. V.

Answesr by Major H. DeBude, (Engineers,) to the Queries marked No. I. and No. II. to which Answers were requested from Capt. A. H. E. Boileau, by the Committee upon the Fever Hospital and Municipal Improvements.—Vide pp. 1 to 12, of this Appendix.

No. V.
Major H. DeBude
(Engineers,) 3rd
June 1841.

No. I.

Query. 1.

Answer. I have not the slightest reason to doubt the correctness of Captain Boileau's Answer to this Question.

Q. 2.

A. As a Channel of Communication, I see no necessity for the Cut through the Dry ground on the South side of the Lake.

For the Drainage of the Lake, it would doubtless be advantageous if accompanied by an Embankment, Dams, and Sluices; but I believe that the present Lake Channel may be used, as far as it goes, for this purpose, and that the proposed Channel is not indispensably necessary. Captain Boileau refers to Lord W. Bentinck, as saying that this Channel would not affect the Drainage, but His Lordship proposed the Channel expressly for this purpose; he said it would not affect the Drainage of Calcutta, not that of the Lake.

It may however be observed, that if the Outlets for letting off the Lake water are not on a level with the Bottom of the Lake, the mere fall of rain water will suffice to flood it again every year, unless the surface is artificially raised.

Q. 3.

A. Captain Boileau's answers to this Query are I believe correct.

Q. 4. Doubtless the Lake Channel would form some obstacle to the Warping up of the portion of the Lake which lies South of it, and it would require an Embankment on each side to keep its own Channel clear.

Q. 5. I agree with Captain Boileau's Answer.

Q 6. Ditto ditto.

Q. 7. Ditto ditto.

Q. 8. Ditto ditto.

Q, 9. Ditto ditto.

No .II.

Query. 1. I believe it to be practicable and desirable to Drain the Salt Water Lake. I do not recommend drainage into the Hooghly on account of the height to which tides rise in the River, as compared with the level of the Lake and adjacent country. The drainage may I believe be effected in the direction of the Tarda Nulla.

No. V. Major H. DeBude (Engineers) 3rd June 1841.

The expense can only be satisfactorily estimated by a person who may be specially nominated for this duty, and who could devote his time to it.

Q. 2. A drain into the Hooghly giving free admission to the tides, would doubtless affect the Drainage of Calcutta, inasmuch as with such a Channel open, there could, for several hours of the day be no drainage at all, the drains being all filled with back water from the River. If the communications with the River were placed under command by means of lock gates, the effect on the drainage would not be injurious, and, as regards the Southern portion of the Town, would I believe be beneficial.

Q. 3. I concur with Captain Boileau in thinking, that the lock gates at Chitpore could not safely be dispensed with.

Q. 4. I believe the Warping up of the Salt Water Lakes to be practicable and desirable, but I think it desirable to Drain them also, and I look on the Drainage as more immediate and more certain in its effects than the Warping. I would however recommend the trial of both. I do not anticipate any injurious effects to the Drainage of the City from either operation.

Q. 5. I agree with Captain Boileau, excepting that I would Drain the Lakes as well as Warp them up.

Q. 6. I concur generally with Captain Boileau.

Q. 7. I do not think it would be right to trust to overfalls alone for letting off the fresh water from the Lake. Sluices would I believe be necessary, but I cannot say how many would be required.

Q. 8. I concur with Captain Boileau.

Q. 9. I concur with Captain Boileau.

Q. 10. Ditto. Ditto.

Q. 11. I have no reason to doubt the correctness of Captain Boileau's answer.

Q. 12. I cannot answer this Question.

Q. 13. I have no reason to doubt the correctness of Captain Boileau's answer.

Q. 14. I think the Drainage of the Lake a certain process, and I recommend it. I do not suppose that the effects of laying its surface permanently dry, will be at any time so bad as that of the alternate exposure and inundation which now occurs.

The process of Warping would, I believe, be very slow, but would I think be ultimately effectual. I recommend the trial of both, but if I were obliged to limit myself to one process, I would prefer the Drainage as more immediate and certain.

CALCUTTA, *(Signed)* H. DEBUDE,
3rd June, 1841. *Major of Engineers.*

No. VI.

*Queries put by a Medical Member (*JOHN GRANT, *Esq. Surgeon) of the Committee upon the Fever Hospital and Municipal Improvements, to W. C.* BLAQUIERE, *Esq. Magistrate, Calcutta Police, and his Answers thereto.*

No. VI.
W. C. Blaquiere,
Esq. Magistrate,
Calcutta Police,
5th June, 1841.

25th February, 1841.

Q. 1. You are understood to have resided for some time back at the Suburbs of Entally. Will you be good enough to say for what length of time?

A. I have resided at Syalda, (not Entally,) since April 1794.

Q. 2. How far is your residence at Entally from the Entally Canal, and how far from the Government House, Calcutta?

A. My residence is near the Bytaconna, about three hundred yards North of the Entally Canal, and about one mile and three-quarters from the Government House.

Q. 3. Is your house well situated, will you be so good as to say, in a street, or in the midst of a piece of open ground or garden?

A. My house is situated on the South side of the Bellyaghat road, in the centre of an open piece of ground, at some distance from the road, and upper-roomed.

Q. 4. Are there trees near your house, and are there many generally speaking in Entally?

A. There are very few trees near my house, but a great many all over in Syalda and Entally.

Q. 5. Which do you consider the most healthy locality, Calcutta or Entally?

A. I consider Calcutta healthier than the Suburbs, that is Syalda and Entally.

Q. 6. On what reasons do you found your opinion?

A. This opinion is founded on the general observation which I have made, of the comparative degree of sickness prevalent in the Town and Suburbs, and the degree of malignity thereof.

Q. 7. Is not Entally more liable to heavy fogs than Calcutta?

A. Entally and Syalda are not more subject to heavy fogs than Calcutta, but on the contrary less so.

Q. 8. Will you favour me by saying which you deem the healthiest Season of the year at Entally?

A. I consider the hot Season the healthiest Season of the year.

Q. 9. Are the Inhabitants subject to any particular class of disease, and what?

A. I am not aware of the Inhabitants being subject to any particular class of disease, except bilious fevers, disordered spleen, and intermittent fevers.

Q. 10. Have you any recollection of epidemics, and of what nature, visiting Entally?

A. I am not aware of any epidemic visiting Entally and Syalda except Cholera, and the Small-pox, at such times as Calcutta has been visited by the same.

No. VI.
W. C. Blaquiere,
Esq. Magistrate,
Calcutta Police,
5th June, 1841.

Q. 11. Have you had any opportunities of becoming acquainted from report or otherwise, with the effects of the accumulation of filth and silt in the Entally Canal, upon the health of the Inhabitants on its Banks, or on the Suburb of Entally in general, and if so be pleased to state what, according to your information and observation, these effects were?

A. I have observed a very material change in the salubrity of Syalda since the excavation of the Entally Canal in 18   , previous to which sickness was very rare in the neighbourhood, whereas since the excavation of the Canal, fevers, particularly those of a bilious type, have been highly prevalent, which I attribute in great measure to the existence of the Canal, and its stagnant and filthy state.

The Inhabitants are of opinion that the bad effects of the Entally Canal, are less felt since the excavation of the Bagbazar Canal in 1835, which has in some measure diminished the evils above stated, by causing an influx and reflux of water into and out of the Entally Canal, which was scarce perceptible before.

Q. 12. Have you had occasion to observe the state of health and appearance in point of health, of the Inhabitants of the borders, or any habitable parts of the Marsh called the Salt Water Lake, or generally to the Windward of such habitations, and the depth of the water, or if deep enough to cover the whole ground or otherwise, and how these spots are affected by the flux and reflux of the tide?

A. *I consider the neighbourhood of the Salt Water Lake exceedingly unwholesome, particularly to new comers; as many years ago, during the time of administration of the Marquis of Wellesley, I had occasion to establish a Police Chowkee in the vicinity of the Lake to prevent the escape of French Prisoners of War by that route, and deputed a party composed of five healthy up-country Birjbassies, the greatest part of whom, to my astonishment in the course of a few days, were prostrated with severe bilious fevers, which rendered it necessary to relieve them, by sending another set, who were equally unable to withstand the pernicious effects of the Malaria of the Lake, and were withdrawn after the loss of two of the number, who fell victims to the Pestilential influence of the Lake, which deterred me from sending any more there.

n/

Natives of Bengal, do not appear equally susceptible of the influence of the Lake, as many reside in the vicinity with impunity, although it is generally admitted to be unwholesome.

My garden not being in the vicinity of the Lake, I have not had opportunities of observing the depth of water in the different parts thereof, or how the same are affected by the flux or reflux of the tide.

Q. 13. How is Entally supplied with Water, and do you consider the Water to be of good quality or otherwise?

A. There are a few Tanks of good water in Entally, but a great deficiency thereof in Syalda, in consequence of which the Native Inhabitants of both the Town and Suburbs in the vicinity of my garden, resort by hundreds daily to a Tank of very pure water in my premises, from which several European families also obtain water, by which my Tank is reduced annually to five or six feet of water.

Q. 14. Are the Tanks quite clean, and free from green scum and vegetation?

A. The tanks in European and Native gentlemen's gardens, are clean and free from scum and vegetation, others not so; and there is a great want of good Public Tanks in my opinion; many who have Tanks not being willing to allow access thereto.

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* Vide Appendix D. p. 152.—J. M.

No. VI.
W. C. Blaquiere,
Esq. Magistrate,
Calcutta Police,
5th June, 1841.

Q. 15. Can you state whether the Water drank by the Native Inhabitants, and poorer Christians, undergoes any filtering or other preparation, before being drank?

A. The Native Inhabitants sometimes filter their water through a cloth before it is drank, but this is not universally the practice, and they observe no other preparation.

Q. 16. Have you noted any circumstances affecting the climate of Entally in regard to Electricity?

A. I have not noted any circumstances affecting the climate of Entally in regard to electricity, but do not think so many accidents occur from lightning in the Suburbs as in the Town.

Q. 17. Any in regard to putrefactive fermentation from decayed vegetation, or from Malaria?

A. I am not aware of any other evil consequence resulting from the putrefactive fermentation arising from decayed vegetation or malaria, than such as may have arisen from the filthy state of the Entally Canal, or the Salt Water Lake itself.

There is a Butchery at Curraya, where Cattle are slain for the use of Fort William and the Town, which may tend to render the air in that vicinity unwholesome.

There are also numerous small shallow Tanks in the Suburbs which dry up annually, that may also emit noxious effluvia.

Q. 18. Will you oblige me by saying whether you have any idea of the amount of the population of Entally, or of the ratio of deaths to births, or can you give me even an approximate idea of the monthly or annual per centage of mortality?

A. The population of Entally is estimated by an intelligent Native at thirty thousand. I have had no means of ascertaining this myself, or the ratio of deaths to births, or the annual per centage of mortality.

Q. 19. Are there any Mussulman families at Entally, if so what may be their average number?

A. There are many Mussulman families in Syalda and Entally, but how many in any one part I cannot say. Many Mahomedan families have left Calcutta and taken up their abode in the Suburbs.

Q. 20. Where do the Mahomedans of Entally bury their dead?

A. The Mahomedans of Entally bury their dead principally at a place called Gobra, and those of Syalda at and near Manictulla.

Q. 21. Are you aware of any facts referable to the vicinity of public Cemeteries in Entally, or elsewhere near Calcutta, as a source of disease?

A. There are several public cemeteries in the Suburbs, but I have never heard of their being considered as a source of disease.

Q. 22. Where do the poorer Christians of Entally bury their dead?

A. The poorer Christians bury their dead at the Portuguese burying ground on the skirt of the Circular Road, North of the Bytaconna.

Q. 23. How is Entally off in regard to Drainage and Conservancy?

A. I have not *have had sufficient opportunity of inspecting the Roads and Drains of

* Sic in Original.
J. M.

No. VI.
W. C. Blaquiere,
Esq. Magistrate,
Calcutta Police,
5th June, 1841.

Entally, to be able to answer this Query. Those in my neighbourhood are generally in good order.

Q. 24. What effect do you think would the Draining of the Salt Water Lake or Marsh, have upon the climate of Entally?

A. I am opinion that the Draining of the Salt Water Lake would be highly beneficial to the climate of its vicinity and Entally, but there are numerous paddy fields between the Lake and the villages in the Suburbs, which are overflowed in the Rainy Season, and dry up after the close thereof, which is injurious to the health of those residing on the skirts of the villages.

Q. 25. Do you recollect any period during your residence in the Suburb of Entally, at which the healthiness of that locality underwent any material change. At what period did such change occur?

What was the state of the healthiness of the locality previous to that period? For how long had you an opportunity of observing it?

What has been the state of its healthiness since, and to what cause do you attribute that change?

What are your reasons for coming to the conclusion you have now arrived at?

A. The healthiness of the Suburbs underwent a material change immediately after the excavation of the Entally Canal in the year —1807 or 1809.

Sickness was scarcely known in my own garden previous thereto, but after the excavation, bilious fevers became prevalent, followed by disordered spleen and obstinate intermittent fevers.

W. C. BLAQUIERE.

SYALDA,
5th June, 1841.

No. VII.

No. VII.
F. Pemble Strong
Esq. Surgeon to 24
Purgunnahs, &c.
8th June, 1841.

Answers by F. PEMBLE STRONG, ESQ. Surgeon to 24-Purgunnahs &c. to the same Queries (commencing with the 5th Query) to which Answers were requested by the Committee upon the Fever Hospital and Municipal Improvements, from W. C. BLAQUIERE, ESQ.—Supra p. 21 to 24.

Queries transmitted, 16th April, 1841.

Answer 5. Calcutta I am of opinion is more healthy than Entally, though Calcutta possesses in itself many causes of unhealthiness, which are noticed, as are also the causes of the unhealthiness of the Suburbs, in the Extracts (marked A. and A. 1. to A. 15. inclusive) of my Papers on the Topography of Calcutta and its Suburbs, which I beg to annex.

A. 6. Because further removed from the vicinity of the Lake and kept in an infinitely clearer and cleaner condition than Entally, where less fire, heat, and smoke exist, both to prevent the formation of Malaria and to check its power when it invades the City. It is a general opinion, though not formed on any statistical data, that those parts of Calcutta nearest the River, are more healthy than those parts near Entally, and as you approach Entally unhealthiness increases, and it has been remarked that persons going from Calcutta to Entally have often been taken ill.

No. VII.
F. Pemble Strong, Esq. Surgeon to 24-Purgunnahs, 8th June 1841,

Of what may be done by Cleaning, Draining, &c. as an example, I would mention Cornwallis Square, now remarkably clean and healthy, a place described by the late Bishop Heber, as having been dreadfully unhealthy—a School and some Missionaries were formerly located in this part of Simlah. I have been many years ago called upon professionally to attend there when they were in the midst of a filthy jungle. The splendid Square and Tank and Mrs. Wilson's School began the Improvements, then the large Scotch Assembly School and the erection of a Native gentleman's mansion, and lastly the Church and Clergyman's House finishes the Improvements—it is now healthy. Baboo Kosseepersaud Ghose and his family when in their old house were extremely unhealthy, since his removal to this place he has enjoyed excellent health.

A. 7. I cannot say from experience.

A. 8. There is a general impression that the Cold Season is healthy—but from a Table of Ten years I have procured of the City mortality, November and December shew the greatest mortality, but I annex general Abstract Tables,—(see Papers marked A. 13. to A. 15. inclusive) one of which shews the mortality in all the months, and I see no reason to suppose the Suburbs differ materially in this respect: the average yearly mortality in Calcutta for these Ten years is *4.64 per cent—of these cholera is found to be among Mahomedans, 0.72 per cent,
Among Hindoos, ... 1.31 pr. ct.
Small pox, Mahomedans, ... 0.119 pr. mille.
Small pox, Hindoos, ... 0.228 ditto.
Various diseases, { Mahomedans, ... 1.73 pr. ct.
Various diseases, { Hindoos, ... 3.80 ditto.
and I find by a comparison among the Prisoners at Allipore and in the 24-Purgunnahs for 20 years a similar result as regards the November and December months.

A. 9. Yes,—Fevers, Dysenteries and Spleen, are among the most common diseases.

A. 10. Yes,—I have known Measles, Cholera, and Small-pox, as Epidemics in Entally in different years.

A. 11. My opinion will be found in the last paragraph of the Paper marked A. 3, and in the first paragraph of the Paper marked A. 4.

A. 12. I have,—the Villagers on the borders of the Lake are great sufferers from Fevers, Continued and Intermittent, Dysentry, Spleen disease, Dropsy, and disease of the Alimentary glands, and their appearance is generally, as I have remarked in Paper A. 2. Para. 9, squalid and unhealthy; see also my observations at Para. 5 of the Paper marked A. The depth of the Lake may be said to be about knee-deep, or from one to one foot and a half deep. I believe that at every reflux of the tide a very great portion of the Lake is left exposed to the sun by day and the action of heat and damp at night.

A. 13. From a very few Tanks and Pools,—the latter are numerous, small, and dirty, and most of them dry during the hot season. See my observations on this subject in paragraphs 1 and 2, of the Paper marked A. 1, and the last paragraph but one of the Paper. marked A. 4.

A. 14. Answered above.

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* It will be seen by reference to my Table of Mortality, which extends to 23 years, for the different classes of Inhabitants of Calcutta that the general per centage of mortality is 4.54—*Sd.* F. P. S.

No. VII.
F. Pemble Strong, Esq. Surgeon to 24-Purgunnahs, 8th June 1841

A. 15. The Natives generally, I believe, adopt no mode of filtering; the poorer class have no time or means, but use the water as it is daily brought from the nearest receptacle; a few of the superior Class adopt some mode of purifying the water, which they purchase from Musulmán and Hindoo water-carriers, but at a dearer price than it is sold within the Maharatta Ditch, and the Hindoos pay nearly double to the Bharrywallas, than the Musulmáns to the Bhistees.

A. 16. No.

A. 17. Yes,—see my remarks in Para. 4 of the Paper marked A. 5.

A. 18. I have attempted, but cannot ascertain the population of Entally itself. I annex a Census of the Suburbs, see Paper marked A. 12. I have no means of knowing at present the proportion of Deaths to Births, or the monthly or annual per centage of mortality in Entally.

A. 19. It is supposed that the proportion of Mahomedans to Hindoos is as one to two.

A. 20. At a Burying-ground at Tangra, Teelzilla, Manicktollah, Kassiabagan, Gobra, Kurbulla; on the road South-east to the Koolya Bridge is the Chinese Burying-ground, and towards the Eastern end of the Balliaghat Road there is a Parsee Burying-ground, and on the same road there is one for the Jews; but as regards the Mahomedans, if their relations reside within 15 or 20 coss of the City, they will often take them to their family vaults.

A. 21. The Mahomedan Burying-ground at Kassiabagan is I know considered unhealthy, from its low situation, and extremely bad Drainage; but perhaps if the above-named evils were removed, its situation as a place of burial, might not be objectionable.

A. 22. There is a Roman Catholic Burying-ground in Sealdah on the Circular Road, one in North Road, Entally, and the new Protestant Burying-ground on the Circular Road, near the head of Park Street.

A. 23. Badly Drained from the great want of Convicts. When I was first appointed Surgeon to the Suburbs and 24 Purgunnahs in 1820, there were plenty of convicts condemned for 14 years and upwards and sent from the Upper Provinces to Allipoor to work on the Suburbs Roads with our prisoners of the 24 Purgunnahs. The Entally Suburb was then kept clean, and many people took their evening drive on those Roads. One gang was stationed at Barnaghur, one in Sealdah, and one at Balliagunge, besides the one now in Entally, and there was one also at Bhowanipore; of these the Entally gang only remains, and from this guard a few Prisoners are sent to Barnaghur. There is a gang of prisoners at Kidderpore, and another over the water at Howrah. I firmly believe that the Entally Suburb can be kept clean and well Drained, for I have known it, as I have said, to have been kept so, and that for a considerable time. I am however of opinion that unless a Regulation is passed, making it imperative on individuals to keep their Grounds in a Cleanly and Healthy state by Clearing, Cleaning, Levelling, and Draining, that all the efforts of even the best directed Conservancy will avail but little to remove the many causes of disease now daily accumulating. See Paper marked A. 1. para. 1, and 2; and the state of the Grounds, described in paragraph 5, of the same Paper, equally applies to the Entally Suburb.

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A. 24. If I would understand the Question as referring to the operation of Draining the Lake, I have no hesitation in giving it as my opinion, after much consideration, that the Draining or the filling up with Silt, or Warping it, would not have an injurious effect either on the Suburbs, or City. Had I thought so, I would not have recommended the measure as far back as 1828. See para. 6, of the Paper marked A 1, and note at foot of para. 4, A. 3, in which I suggest Draining and Warping. I am aware that in some Climates such an operation might be attended with danger; but here, where the Sun is all powerful, I conceive any Malaria formed under such circumstances, would be rapidly dissipated by its pervading heat. The illness produced by Drainage near Chartrese, in France, is, I humbly submit, no guide to us in this Climate, for we find in more moderate Climates than this, that the Marshes made for Rice cultivation are much more injurious than Rice Marshes here. In giving the above opinion, I would be understood, that the Land once Drained shall not be again flooded, as it now is, by every alternate tide. I however am of opinion that Warping the Lake would be the most advisable.

With respect to the effect that would be produced on the healthiness of the neighbourhood after all the operation in the Draining or Warping is over, there can be but one opinion, and that is, that it would most decidedly produce healthiness.—See my observations on that point in my concluding paragraph of Paper A. 1.

A. 25. I have already remarked, that 20 years ago, and for some time afterwards, the Suburb of Entally was kept in a cleanly state; and from inquiries I have at various times made of Native doctors and others, the place was then more healthy than it has been of late years. I have officially reported to the Sudder Nizamut Adawlut upon increasing Suburb unhealthiness, and I brought the bad state of the Entally Suburb particularly to the Court's notice in the middle of the year 1828, I find in the year 1830 that I twice again remarked in my returns to the Sudder Court upon the unhealthiness throughout the Suburbs, and in this year I brought the same to the notice of the Medical Board. In 1833-4, I recollect that Entally as well as the other Suburbs were particularly unhealthy, and in the latter year the Magistrate recommended Government, at my suggestion to establish an Hospital and Dispensary at Kidderpore, that place being remarkably unhealthy. At this time I again officially brought to the notice of the Medical Board the extreme unhealthiness of the Suburbs, and in a letter to the Board, again in 1835, I repeated my sentiments upon the same subject. My impression is, that since the Inundations there has been a uniform unhealthiness throughout the Suburbs, I do not mean from any continued effect of the Inundations up to this time, but from the want of Prisoners or Workmen. If the former custom of sending Up-country Zillah Prisoners, convicted for fourteen years to work in the Suburbs of Calcutta, were again adopted, I believe these localities may be brought into their former cleanly state, although this would not effect all that is urgently necessary for perfect healthiness. See my Answer to Query No. 23. I have already enumerated what I consider the cause of unhealthiness, and my reason for thinking so, see Paper marked A. 5. paragraph 4, and Paper marked A. 7. paragraph 4, and following paragraphs.

I am inclined to think, in Rome and many other malarial countries, where the Thermometer does not rise so high as in Bengal, that the climate is influenced greatly by the *Character of the Soil* which perhaps remains *more permanently moist* than it does in Bengal, which is a sandy soil, and allows the water to pass quickly downward; the subject is admitted to be full of difficulty, and the opinions of the best authors conflicting. It is not possible to analize Malaria, to say at what point of heat, with moisture and assisting vegetation it begins, or at what exact point it is dissipated by the Sun's rays or other heat;

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perhaps the heat of a pipe or cheroot, or the warmth of the human breath, within gauze, may often prevent its action on the human subject. In the Mediterranean fires made where the sailors were procuring wood, prevented its action, where, previous to the adoption of the fires, it produced disease—but Dr. Macculloch, who tells us this, says distinctly, that Water does not check its progress, and gives proof by noticing a ship, three miles out at sea, having its crew affected by a Land wind; and he believes that wind conveys Malaria from the coast of Holland to England. Great changes in healthiness have taken place in Calcutta since my residence here, although the Thermometer has not been changed as regards heat, it is therefore fair to conclude that Improvements have been the cause. We now rarely meet with the virulent jungle fevers formerly so common. In following up these Improvements more extensively, a still greater degree of healthiness may be expected—for it is not heat alone, or damp alone, that produces Malaria, but a union of these at a time while decomposition is going on in certain matters.—Cleanliness, Airiness, Leveling, and Draining, then, are the Preventive measures to effect the desired Improvements.

F. PEMBLE STRONG,
Surgeon to Mysore Princes and 24-Purgunnahs.

CALCUTTA,
8th June, 1841.

No VII. *a.*

Extracts—Papers on the Topography of Calcutta and its Suburbs, by F. Pemble Strong, Esq. Surgeon to 24-Purgunnahs, &c.

Letter, dated 29th August 1837, *from F. P. Strong, Esq. to T. Smith, Esq. Superintending Surgeon, Presidency Division.*

A.

SIR,

In answer to your Circular of July 29th, forwarding for my perusal a Letter from the Secretary to the Medical Board to your address, expressing the desire of the Board to afford every practicable assistance to such gentlemen as may be engaged in drawing up Topographical accounts of Stations in your division; I have the honor to forward copies of several Papers, written some years ago, upon this City, its Suburbs, the Salt Marshes, and the Soondurbuns, South-east to the Sea; and to which I have added notes in the Margin in further elucidation. I also have annexed other papers more lately written, bearing upon the same subject, and a letter to Lord William Bentinck written by a Committee which was formed of gentlemen in the Suburbs, in consequence of my first communication upon the subject in 1828. A small map shewing the bearing of the different parts alluded to is appended, in which Mr. Tassin has, at my request, painted the Salt Lake of a bluish colour, and the low thick salt-water jangal, between the further end of the Lake and Tarda, green; while he has represented the lands granted to various persons towards the end of the year 1829 and in 1830, in yellowish green colour; to shew their position, the line drawn with carmine points out the new Eastern Canal, the purple shews the old route by Tolly's Nullah, and the orange shews the route by Channel Creek. This is a map made only last year, and is not the map I allude to in my papers for further information. There is a large one of the Lake

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and Calcutta by the late Captain Prinsep, giving the Levels also; and there are other larger Maps by Tassin, of Calcutta and the Soondurbuns, shewing all the individual Grantee's grounds, numbered, and pointing out the new Eastern Navigation, projected, and partly carried into execution, by the late Major Schalch, in a more particular manner than this small Map will admit of. One of the Letters annexed, will shew that I was called upon by the late Governor General, Lord William Bentinck, to attend a Committee at the Government House upon the subject of Draining Calcutta, and the Drainage and Silting up of the Salt-Water Lake. The Committee was composed of fourteen gentlemen, and His Lordship alluded to his own experience in such matters having induced him to call this meeting, in order that it might be continued by his successor, and mentioned his communications with the Court of Directors, and their assent to his views in the affair of Draining the Lake. The Committee was to meet again, but His Lordship's illness prevented it, and the subject appears to have slept ever since, except that the public prints have occasionally thrown out the views of different writers interested both for, and against. His Lordship had his own Plan for Draining the Lake printed, together with that of the late Captain Prinsep, and his Questions to that gentleman and the Answers thereto. There were also some other Papers annexed to these, bearing upon the subject, all of which I gave to Sir John Grant, who has given them to Lord Auckland. They are interesting as connected with the subject of my Papers, and should I be able to obtain a copy from the Military Board, or elsewhere, I will send them to you. I would add, that, when I first waited upon the Governor General, no part of the Eastern Circular Canal had been commenced upon, not a hoe had been applied to the ground, nor had a tree been felled; and I then understood, that, although the whole ground had been purchased by Government for the entire line of the New Eastern Canal, from its entrance from the Bagh-bazar floodgates to the old Entally Canal which runs into the Lake, yet, that some obstruction, or difficulty, presented itself to this improvement being effected. Viewing this as the Nucleus of all Improvement with a view to effect a Healthiness in this City, I took with me a Map of Calcutta, with the projected Canal drawn out in pencil, the more clearly to point out what I conceived of the utmost importance, and I was gratified to find that His Lordship took the same view of it that I did, and acted upon it, though I was given to understand that he met with considerable opposition; it is now however finished, and has been so for some time; there is considerable traffic upon it, and the monthly tolls form a considerable item of profit, although the failure of the Mercantile Houses has materially deteriorated the value of the ground Government have to dispose of on each side of this Canal. It has six Suspension Bridges over it, and a pucka road on its western bank.

The First Paper marked 1828, may be considered entirely Topographical, and was written about the time that I addressed the Sudder Nizamut Audawlut upon the general unhealthiness of the Suburbs of Calcutta. I informed the Governor General that I had made such a report in my Official Correspondence with that Court—and I found afterwards that my remarks were recommended to the attention of the Governor General in Council. This led to a Communication with the Magistrate of the Suburbs and 24-Pergunnahs, then one District, bringing my report to his notice, and desiring his attention upon the subject; he immediately put himself in communication with the Entally Committee, and sometime afterwards Mr. John Master, the Magistrate, shewed me a Plan of his own, for the Improvement of the Suburbs, and the Sites were marked upon his Map of the 24-Pergunnahs where he proposed to have Large Tanks excavated, and Roads made. Besides this, the Entally Committee had several interviews with Lord William Bentinck, and gave into His Lordship's hands their Plans of Improvement, of which the Letter I have alluded to, and annexed, forms only a part; they also gave in Maps of the Jungles, Roads, and Grounds

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generally, and the then price of the Land, &c.; Sites for Tanks were I know fixed upon, and marked; but His Lordship went up the country, and nothing has been done.

The Second Paper was written some months afterwards, and may be considered as departing, in a small degree, from strict Topography, since I have intermixed the subject of Soils, and of Boring for Water, Agriculture, &c. but as regards the proper formation of Tanks, the Draining off of Water, and Wells, perhaps these subjects may be considered admissible as regarding Public Health. The New Canal had been begun, and was rapidly going on, and that work threw some light upon the general nature of the soil, and confirmed the opinion given by Sir Hyde East, that the dampness of the climate was not to be attributed to the moist nature of the soil, which was thought by some to be full of springs; and it also confirmed his opinion of an ancient Forest having in former times existed much below the present surface of the earth, which however may have been forced by torrents to their present position, as numerous and large trees were every where met with—many of them in an erect position.* Such was also found to be the case in the New Canal made by Major Schalch, running Eastward from the other end of the Lake at Bamonghotta to Hoosinabad; some of the wood had arrived almost at the state they call lignite. Most other parts of this paper are essentially Topographical, and point particularly to facts, and to unhealthy localities, and although towards the end of the paper, I have advocated particularly the growth of Cotton in the Soondurbuns, as well as Coffee and Sugar, I do not like to separate or divide the paper, for I advise the measure as a main means of reducing the Jungle and Forest, and consequently of reducing Malaria. And if my Third Paper should be thought to give a long detail regarding Boring, it yet shews the exertions that were necessary on my part to keep the experiment going; and we have now attained a depth of upwards of 400 feet, well tubed with cast iron, and the operation is going on with spirit. My further remarks advocating the cutting down the Soondurbun Jungles will, I hope, though a little lengthy, be pardoned, as tending to produce a more healthy state than at present exists. I fancy myself further borne out in not selecting parts only of these Papers, or altering their original diction, from the " Sketch" of a Plan for Memoirs on Medical Topography sent round with the Circular by the Medical Board to guide us in some degree. I there see Seas, Rivers, Lakes, Wells, Morasses, Bogs, and Canals, noted as points on which the Topographer should bestow considerable attention, as they so materially affect the dryness or moisture of a Country. The Deposits, animal, vegetable, and mineral, are also mentioned, and among several other matters which I had touched upon, I find Evaporation of surface, and Vegetable Products mentioned, and an allusion to the comparative healthiness of the Villages in the *Netherlands,* as ascertainable by the inspection of their Wells; and the state of Agriculture, and Population, being also mentioned, makes me hope that I shall not be blamed for not leaving out what I have said of Baron Humboldt, and also of the Campine of Brabant in the *Netherlands,* and the Abbé Man's remarks *upon the same;* and I need not apologize for what I have stated from Macculloch's work on the prevalence of Epizotic diseases appearing among Cattle, at the noted Seasons of Epidemic Fever among men, because I find in the " Sketch" circu-

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* The Superintendent, a very intelligent Native, informs me that in the Canal beyond the Lake the trees were many of them very large, and were found in the greatest number about 30 miles beyond the Lake near Hoosinabad; many were very rotten, the rest were used for burning. Among them he recognized the Soondry, the Byen, the Gouah, and other forest trees; their trunks were of all sizes, and he supposes that along a line of 30 miles they were in number from 5 to 15 in a mile. As to the depth of such trees, those I saw in the nearer Circular Canal had their roots about or somewhat below the bottom of the Canal; and I saw a large tree, about the same depth, in a Tank digging on the borders of the Lake: the workmen said this was a Jack tree. —Aug. 29, 1837.

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lated by the Board, that, that is a subject that should be inquired into by the Topographer. Indeed, I should have found a difficulty in making any alterations in my Papers.

It will be seen in the accompanying Papers, I have alluded to Mr. Martin's paper on the Medical Topography of Calcutta and its Suburbs, but there is one part of it which I have omitted to refer to, but which, as *Surgeon to the Suburbs* and 24-Pergunnahs, I ought perhaps to notice. Mr. Martin suggests that the Police Surgeon should report upon the state of Habitations, Sewers, Streets, Roads, Tanks, &c. and that he "*should also report minutely on the state of the Suburbs.*" The late Dr. Vos, the then Police Surgeon, in whose opinion as to the necessity of Improvement in the Suburbs I fully concur, was accordingly called upon by Mr. Martin for his sentiments. Mr. Martin was not I believe, aware, that my duties as Surgeon to the Suburbs, had not only brought to my attention the importance of the subject, but had induced me, at an earlier period than the Date of his Papers, to make the repeated Reports detailed in the accompanying Papers. I merely allude to this, as any person reading only Mr. Martin's Papers, might be led to infer, from the suggestion to extend the duties of the Police Surgeon to the Suburbs, that the Surgeon of the Suburbs had omitted all notice of the obvious causes affecting the health of that portion of the District under his charge, whilst in reality it has not been for want of representation of their bad effects, that the various causes of unhealthiness in the Suburbs have been allowed to exist in their full vigour, and until as I am glad to observe, they have at last attracted the notice of other medical officers, besides myself. Finding that the printed Papers advocating the Fever-Hospital, &c. were in circulation, I forwarded to the Government the three first of the accompanying Papers, and that upon the effect of the Inundations, and I received from Mr. Mangles an answer, that my opinions would not be overlooked when the matters to which they relate came under the consideration of Government. I annex a copy of the Correspondence for your information.

The Fourth Paper, which I admit to be rather rambling and irregular in its character, was written, as far as I can recollect, in 1830, at the request of the late Captain Herbert; and is in continuation of some Papers I had already given him upon the same subject, but which had relation more particularly to the City and Native Town of Calcutta, also including the Lake and Soondurbuns; but Captain Herbert required further information respecting the Suburbs; the *filthy* state of them he thought was the more immediate cause of sickness here. He said he considered that in these parts there was not sufficient space to breathe, without inhaling disease, and that the luxurious growth of vegetation every where existing among the Huts and Villages, produced the Malarious atmosphere, which not only influenced the Suburbs, but extended its effects to the City. He intended to have published his opinions in his "Gleanings in Science," as remarks on the Malarial Topography of Calcutta and its neighbourhood. Indeed he had begun this Paper, and had considerably advanced in it, when his departure from the Presidency caused him to transfer the work to other hands, and he then gave up his Paper upon Malaria.

This Paper or Memorandum is copied from a rough paper intended simply as a skeleton for Capt. Herbert to build upon; loosely written as it is, it may not be irrelevant to the subject of Topography, as it contains some allusion to facts, which may not be altogether useless.

All the above Papers were written seven or eight years ago, but the next paper, or letter, which, although long, is a question altogether about Climate, was for the information of the Commissioner of the Districts contiguous to Calcutta; and in answer to an inquiry issued on the part of Government, endeavouring, if possible, to select the more healthy from the unhealthy Districts, with a view to send Prisoners who are banished, to those Districts that are found to be the most healthy. It will be seen in this letter, that

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I enter upon the subject with as much care and attention as I can command ; the subject was a difficult one, and it was an answer to a Circular which was addressed to all the other Civil Surgeons as well as to the Magistrates ; and the Commissioner informs me that my letter was the only one of all those he received, that he had forwarded to the Superior Court, the Sudder Nizamut Audawlut; and he said he did so, because he thought it contained a good deal of useful information ; such being the case, I hope I shall be pardoned for forwarding it to you on this occasion.

Perhaps the health of Prisoners in a District may not be altogether a very bad criterion of the healthiness, or otherwise of a District. The question had reference to banished Prisoners ; and those in the Allipore Jail being all banished Prisoners, and for life also, induced me to make a comparison of the mortality among them for a series of years. I found the average mortality little more than 5 per cent. which, considering that every man must die there, the proportion did not appear great. In Cities and other places, and departments, as in the Army with a regiment, or in other Services, men retire, become pensioned or otherwise quitting, leave the field for others, and do not remain to swell the mortality ; but in this Jail, where men, many of them coming in advanced in age, are located for life, a larger mortality ought to be expected than among other bodies. I therefore come to the conclusion that it is healthily situated, and it will not appear inconsistent with my opinions, expressed in the former letter, as to the general causes of unhealthiness, because those causes are obviated in this particular case. The Jail is in an open space, clear of jungle, and these Prisoners are free to breathe good pure air in the absence of all jungle, filth, bad water, and other nuisances of which I complain, as affecting the Suburbs generally. The air is clear, and the Jail Tank probably the best of any, either in or near Calcutta ; and I think it is an instance which goes to prove the correctness of the opinion of those who see sickness and death produced by Malaria where it is allowed to exist ; as for instance, in the character of the disease and death which I allude to in the margin of my Second paper, in the case of Prince Sooroodeen, who allowed jungle to grow up to his very doors at Russapaglah, and whose continuance of life for several years was a source of surprise to myself. It may be that the quantity of Opium he took may, for a time, have counteracted the poison of Malaria which killed his only two sons when infants, and spread disease among his domestics. The Mr. Ward I allude to in the margin of the Memorandum for Captain Herbert, is another strong instance I would add in proof, and in addition to the facts and localities I point out in my earlier papers, I am sorry now to add another case to swell the list of mortality arising from the same cause. In all other respects, a most intelligent Native Doctor, who had been in my service for nearly twenty years, could not be made to understand that his continuance in his Family House at Bhowanipore, surrounded by Malaria, would be the death of him. I often so assured him, and took the greatest pains for a year or two, but all without effect ; an old Jungle Piggery, inhabited by Chumars and Pigs, was the place of his residence, and his Diseases were first intermittent and remittent fever, dysentery, spleen, and he died dropsical.

The Allipore Jail I consider to be situated in the healthiest part of the Suburbs, and the whole of Allipore being, perhaps, somewhat higher, and better drained, or from the nature of its soil, which is sandy, does appear to me to have advantages over all the other Suburbs, if perhaps the open and airy part of Balleegunge be excepted. If I am rightly informed, the Inundations of 1833, which produced sickness in every house in Garden Reach, had not any serious effects either in the open parts of Balleegunge, or Allipore, while all the Inhabitants of the rest of the Suburbs were considerable sufferers, and great mortality was produced among the Native population of those parts.

The consequences of this flooding was felt even in the City, for by the Police reports the mortality in 1833 nearly doubled that of the preceding year, no doubt increased by

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the vast number of the 24-Pergunnahs sufferers, both rich and poor, flocking into the City, turned out of their habitations by the floods, and arriving also for medical aid, as I have remarked in my paper upon the subject, written just after the Inundation. The soil of Balleegunge I have found by the borings I have made there, to be very sandy, (indeed the place takes its name from *bálú*, or sand,) which is highly calculated to carry off, or absorb superfluous water; and I would here remark, that the Lands to the South-east, as far as Gurriah-haut, and very far beyond that place, are an open Plain, and are generally, with the exception of Garden cultivation, cultivated with Rice or Tobacco, to the extent of many miles, say twenty; and it is only here and there that Villages are to be seen, and these at a great distance from each other. It appears to me, and I wish to press it upon the minds of those who consider this subject, that the Malaria Calcutta has to complain of, is very greatly, although not entirely, in the surrounding crowded Villages, and more particularly those to the Eastward, between the Salt Lake and the Mahratta Ditch;—for, admitting, what now seems to be uncontradicted, that this Lake is highly productive of Malaria, the *Air* when the wind is Eastward of us, has to find its way to our City, only over Swamps, Jungles, and Villages—themselves highly productive of the same Malaria, and therefore not calculated to dispel the evil. The advantage enjoyed by Calcutta when the wind is South, is, that it passes over a large tract of country with very few villages; besides which there is the fine Maidán South of the City, to neutralize what Malaria it possibly may contain: a similar remark may be said to apply in some degree when the wind is in the North;—and on the West, the River is some safeguard;—but the Eastern is notoriously the bad wind, and I think here it is sufficiently accounted for.

Should the researches, now making, tend to a better knowledge of these facts, some attempts at improvement may commence. Very slow and gradual Improvements have, no doubt, been adopted by the few Europeans and others of intelligence, who have at different periods inhabited our Eastern Suburbs, so much so, that among Europeans, life is much more safe than it was half a century ago, when we know, from well authenticated records, that the mortality was frightfully great; and we find the Salt Water Lake recorded as the most prominent of the causes. Should cleanliness ever obtain in these Eastern Suburbs, and the Salt Lake become Drained and Cultivated, I entertain no doubt whatever of great healthiness being the result; and one great advantage attending the Drainage of the Lake would be, that the country between it and the City would immediately improve, become more valuable, and be the resort of a more respectable population.

However Malaria may be generated, there can be no doubt that it is produced most abundantly in all those parts of Bengal, which are not cleared of Jungle, Drained, and kept Clean. Within my recollection the Maidán south of our City, was more swampy, and covered with a coarser grass than it now is, and many parts of the Native Town, and Chowringhee, are much improved, broad Roads and Squares having been made; and it is quite obvious, to me, that Fevers and Diseases in general are by no means so common as when I commenced practice here. I am so certain on this point, that I will not waste time by entering into particulars. Further Drainage and more free Circulation of air will still farther improve the Public Health; and it is admitted on all hands, that attention and improvement in our City Drains is indispensible to effect the good desired.

Yet, I think we must look to the Improvement of the surrounding Suburbs, and Lands beyond, effectually to render this City as healthy as it can be made; and without attempting to investigate the chemical analysis of Malaria, or to describe what medical treatment should be adopted for diseases produced by this poison, I will endeavour to draw attention and point to the numerous causes existing all around us.

Let us look around us, and we find all the essentials necessary for the formation

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of Malaria; beyond our City, Jungles, Lakes, Marshes, Gardens,—crowded with trees and woods of every description.—Weeds, stagnant Water, filthy Pools, and low grass jungle of every kind, surrounding the Villagers' habitations. In these exist ample means for a constant supply of the Poison, assisted, as they are, by the natural heat and moisture of the climate; but when unnatural or meteoric changes of climate take place, or when unnatural Inundations of Sea, or River water occur, then, as we should expect, we find Disease and Death scourge the land, as was instanced by the Inundation of 1833 in particular, and as shewn by all the other* Inundations also. Such excess of mortality is to be expected in Bengal when Inundations, or unusual moisture, followed by great heat, occur. As a common cause of the constant Malaria that prevails here, I would mention the *exposure of a vast expanse*† *of wet mud*‡ *on the receding of the tide from the Salt Water Lake,* and the banks of the numerous Rivers, and tide Harbours;—it would not be difficult to enumerate more causes, but the above are sufficient. Within the City, among numerous other causes, we find Sewers and Drains sadly neglected, allowing their decomposed and decomposing animal, vegetable, and other substances, to sink into the earth, instead of Draining off as they should do into the River or the Circular Canal. Here perhaps in some particular state of the ground, the soil may be of a nature calculated to receive the poison, and it probably condenses and accumulates, forming, as it were, a permanent attachment to the spot, and for what we know, certain peculiar solid bodies, casually exposed to it, may receive it also. Whether the poison be produced by common putrefaction, or by any peculiar change in the elements of vegetable matter, dead or dying, it seems to be admitted that we know not its exact chemical character, though it is acknowledged that it is produced and propagated by Wet soils, Hot countries, a particular State of Atmosphere and high temperature; and with this knowledge we do possess power to controul and check, to a very considerable degree, this extensive cause of mortality. We know by authentic records that it is but little more than a Century ago when London, from its then filthy state and bad drainage, was subject to very great mortality, and as civilization has advanced, the Countries as well as the Cities in Europe have also improved in Healthiness.

Dr. Bisset Hawkins describes in his work lately written on Medical Statistics, that

* Those of 1831, 1832, and 1834,

† The extent of the Lake is 18 Square Miles.

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‡ Dr. Macculloch remarks, " How far mere mud, the apparent produce of the Sea, or left by the recess of the tide in Ports and Estuaries, and at the mouths, or on the banks of tide rivers, can or does produce Malaria, is one of the questions on the subject which has been argued on different sides. That such mud appertaining to fresh waters, and laid bare by the Summer heats, in Lakes, Pools, and Canals, does produce fevers, and of a very serious character, has been formerly shewn. "

And again,

" Or as it is the effect of tides in Estuaries under similar circumstances to reject and often therefore to expose the mud brought down by Rivers, it is plain that even without the presence of marine plants or their remains, such mud must often be in the same circumstances as that of Lakes in Summer. "

As to the River banks in America, we have the authority of Volney, the accuracy of whose observations can seldom be questioned, that every River in that Country, whether rapid or stagnant, produces Malaria and Fevers.

In France we have the authority of Mons. Falcon as to the pernicious character of Canals in France; he enumerates them generally all through France as sources of Malaria. Indeed the opinion of a host of writers who have studied this subject, go to prove that the banks or margins of Rivers and Canals generally possess all the essential qualities of a marsh, as a diminution of the waters may *expose* mud *impregnated with vegetable matter.*

I have in these Papers given some instances of unhealthy localities from the above causes, and could, were it necessary, give more from personal observation and experience. That such confined spots, as muddy banks of Rivers and Estuaries, do not act far beyond their immediate limits, that they do not produce the same wide effects of disease as extensive marshy tracts, does not prove that they are not sources of Malaria.

17th September, 1837. *(Signed)* F. P. S.

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mortality has diminished in nearly the same degree, in which the prosperity of these countries has gradually increased. In England and Wales, for instance, the annual deaths were, in the Census of 1780, so numerous as 1 in 40. In 1801 they were 1 in 47. So in France (a more Malarial country it might have been remarked) the annual mortality was, in the year 1781, 1 in 29, and in 1802, 1 in 30. In London he considers that now, 1 person in 40 dies annually; while he gives the mortality of England and Wales, at the present time 1 in 60; a considerable improvement since the year 1780, when it was 1 in 40.—Doctor Hawkins gives the Mortality of various Continental Cities, and compares them with the country mortality, which it exceeds in every instance. He remarks that Mortality, or the Calculation of the Number of Deaths which occur in a Country or Town, has become an important object of research; and that Tables are formed in almost every Civilized State by direction of the Government, in order to ascertain the point.

In some Districts this amount is increased, or diminished in a slight degree, by direct, and by local causes; but, on the whole, it appears that the good or bad condition of a people, the possession of the necessaries of life, or their absence, mildness, or rigour of the mode of Government, the advance or retrogression of knowledge, are the principal circumstances which influence the result. The greatest difference of Mortality in City and Country, appears in Holland, where in Amsterdam the deaths were 1 in 24, while in the country it was 1 in 48. In the City of Naples 1 in 28, in the Country 1 in 35. In the City of Paris 1 in 32, in France 1 in 40. I may be allowed to quote Dr. Hawkins' concluding reasoning upon this important subject: " Life and Death, then, mainly depend upon the *prosperity* of the circumstances which surround us: physical prosperity and moral happiness, which often depend, and re-act upon each other, present a safeguard at every crisis of existence, both to individuals and to nations. We may often judge with tolerable accuracy of the mortality which is likely to exist in any given Country, Town, or Hospital, from the degree in which poverty or wealth, knowledge or ignorance, misfortune or success, are seen to prevail; wherever want and *misery* exist, there the mother is more likely to die in labour; there still-births will be more frequent; there the deaths during infancy will be more numerous; there epidemics will rage more violently; there the recoveries from disease will be more tedious, and the fatal termination of it more probable; and there also will death usually approach at an earlier period of life than in happier situations." It will be seen in the Statistical Account of the British Empire, just published by J. R. Macculloch, Esq., under the head of "Vital Statistics," that between the years 1813 and 1830, he calculates the annual mortality in London at 2.84 per cent. and for six *Towns* in England for the same number of years as at 2.95, and he estimates the mortality at Glasgow between the years 1821 and 1835 at 2.83 per cent., whilst he gives a detail of Wales and forty Counties, shewing in every instance a considerable decrease of mortality as compared with London, Glasgow, and the six Towns above cited. The above mentioned book has numerous tables upon points of mortality, and contains other information upon the same subject of great interest.

With regard to this part of India, I mean to confine myself to Bengal. I think the reverse of what occurs in Europe as to mortality will be shewn, when we obtain Statistical Reports that can be relied upon; and whatever may be the healthiness, or otherwise, of the other Bengal Cities, I expect it will be found, that in Calcutta there is less mortality than elsewhere generally in Bengal, though it cannot be expected that we should shew so small a mortality as exists in the City of London, or the other European Cities.

In England and Wales the poor are taken care of in Workhouses, and the sick poor receive good medical and surgical advice and attendance in Hospital; but in India, where the knowledge of medicine, and the healing art is the same as it was many centuries ago; where in place of a sympathetic feeling for his fellow-man, there not only prevails an

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apathy in the Indian character, but where a division of caste prevents the agency of good-will and assistance of one towards another; where insufficient clothing, bad food, bathing at improper times, and the practice of fasting for long periods, (adopted both by Musalmáns and Hindus,) and where the Hindu ceremony of Antarjalí, which is so general,—taking the sick to expedite their death upon the muddy bank of the Ganges—prevails; added to all this, the want of advance in civilization and knowledge, and taking into view the extensive sources of Malaria so much dwelt upon, the existence of which I conceive, must, in a great measure, proceed from the want of knowledge and advancement in intelligence above alluded to, we must naturally expect to find a greater mortality here than in Europe.

The housing and habits of the Bengális which I have attempted to describe in the 9th paragraph of my letter to the Medical Board, dated March 21st 1835, all seem to have a tendency to deteriorate and shorten life. The Diseases of Bengal are nearly all produced by Malaria, and bear a very strong analogy in character to the Diseases formerly prevailing in European Cities and Countries, in times more uncivilized than the present. Sydenham, speaking of those times, says, Cholera comes almost as constant at the close of Summer, and towards the beginning of Spring, as Cookows towards Midsummer. He closes an accurate description, by remarking, that it "often destroyed the patient in 24 hours." Dr. Craigie has demonstrated the antiquity and identity of Cholera all over the world. The description and remedy for Cholera, (taken from the work of Hermannas Vander Heyden, a physician of Ghent, dated 1653,) published in the 1st vol. of the *Gleanings in Science*, I myself sent to the author in 1829. The remedy, as far as the opium and *Henbane, Hyoscyamus*, or the *Khorásání ajwayán* is concerned, I can speak of myself most favourably, from extensive experience. The author remarks, that the taking of it (the remedy) is not to be deferred so long, as that the patient is fallen into convulsive fits, and his *excrements* are of the *colour of Whey, which are evident signs that nature is spent in him*, for then it must be taken with *all speed*, &c. Fevers, remittent, intermittent, and anomalous, with Cholera, Diarrhœa and Dysentery, Spleen, and all the Nervous disorders under the head of *Neuralgia*, are the prevailing diseases both among the rich as well as the poor Natives of this Country. We find the Baboo of both Calcutta and the Mufassal passing through a life of disease and misery, and dying early in life, somewhat similar to our European Barons of old, who are said seldom to have attained to an advanced age, the filthy moats surrounding their Castles being supposed to have been the main cause; so here, I have often had occasion to remark, in and about Houses of opulent Natives, causes sufficient for all the mischief alluded to.

In conclusion, I will add some Tables [See Papers marked A. 13. to A. 15. inclusive,] of the Census of Calcutta lately taken, with the mortality of the Natives for the last five years, taken from the Police Books. Captain Birch began this year to procure the Births, so that in future a more correct estimate may be formed. The great difference in mortality between the Hindus and Musalmáns is striking,—while the difference to be observed between the Portuguese as compared with the English and the Eurasians is equally so.

Here is much room for speculation, and it cannot be said that as yet we have as good means of getting correct information upon this subject as they possess in Europe; nevertheless, we may approach as near as we can to the point we wish to ascertain, and we may hope to improve in such Statistical Records. If we are at all near the truth, the result seems to agree with the opinions formed by Dr. Hawkins in his conclusions and summing up upon the subject, just above referred to, and quoted. The Portuguese, among whom so great a mortality is shewn, are a suffering race, greatly subject to the catalogue of complaints enumerated in these papers,—while the English and Eurasians are far more prosperous in life, and enjoy comforts and happiness in a very high degree, as compared with the former

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section of society: the mortality of the latter is 3½ per cent per annum, while that of the former being 12½ per cent, is very great. In 1830, I ascertained and published in the "Gleanings in Science" the burials in Calcutta of Protestant Christians from the year 1820, to shew at that time, that although the European population must have greatly increased, yet that the deaths and burials had not increased; and now that the same population is acknowledged to have increased very materially indeed, yet we see, upon referring to the first column of one of the tables, giving the Protestant burials for the last 20 years, no increase of Deaths. The years 1833–4, the two years following the Sea Inundations, shew the greatest mortality of late years; while among the Native population those two years shew an extraordinary mortality. The two last years shew, that in both European and Native population healthiness is restored. The mortality among the other columns of Sections of Society, the Catholic, Greek, Armenians, Hindus, Armenians, and Native Christians, are for the last 20 years, and I believe them to be nearly correct. The Chinese and the Jews keep no account of their burials, I of course could not include them—and they form a small portion of Society in this City. The Census is the one last taken by Captain Birch, and he took great pains to make it as correct as possible. You will observe by one of the letters annexed, that, upon the receipt of your Circular, I addressed the Magistrate of the 24-Pergunnahs, requesting a Census of the Zillah, together with the Mortality; and you will see his obliging answer to the same: the Census I send is only of the Suburb Division, which forms only a part of the District.

I have, &c.
(Signed) F. P. STRONG,
Surgeon to 24-*Pergunnahs.*

August 29, 1837.

Appendix to the foregoing Letter.

I find I have omitted in the foregoing Letter to notice what has been done at different times in the Suburbs of Calcutta, when Cholera has been scourging those parts, and carrying off all its victims who could not obtain, or who declined, medical aid.

It is but justice to the Native Doctors who are permanently appointed to the different Gangs of Prisoners on the Suburban roads, as well as the Native Doctors attached to the Mysore Princes, that I should state how eminently successful they have been in saving Life under these dreadful circumstances, and this has been a work they have at such times performed, independent of their actual duties. I think I may say that, taking the average of several years, the mortality among Villagers has not been more than 6 per cent. of those attacked with Cholera, where the above mentioned Doctors, and others appointed temporarily to assist on urgent occasions, were called to the patient in the early stage of the disease; and the average of the last sixteen years gives a proportion of 6⅔ per cent. among the Prisoners attacked with Cholera at this Sudder Station. A like favorable result attended the Native Doctors appointed at Bombay, when the Cholera became epidemic in that place, and Dr. Ogilvy, the then Secretary to the Medical Board of that Presidency, remarks that it was not ascertained that any case of cholera *had recovered* in which medicine had *not* been administered. 1204 fatal cases of Cholera were reported by the Bombay Police, in none of which cases had Medicine been given. Should this be the case in all situations among the poorer Natives of India when Cholera prevails, might it not be considered as a highly to be desired act of benevolence on the part of Government, that Native Doctors should be permanently fixed at different points? Say one, or two, with a supply of Medicine at each Thannah,

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immediately to render assistance in case of any illness, whether fever, or otherwise, for although it is possible, that every case of Cholera reported as such, may possibly not be actual Cholera, yet it probably may be a formidable disease, and would be immediately relieved; while Fever, Dysentery, &c. would receive a check, and most cases of Cholera would be cured at once. The subject is an important one, and probably much better plans than those I have suggested may be put forward by others, and adopted by the Government. I would only here remark, that such remedial measures may be the means of preventing much serious disease, and to a certain extent, preclude the necessity of Native Hospitals. The Natives themselves seem to have a great objection to quitting their homes and mixing with different classes of their fellow-men.

It appears to me that, as a means of checking the progress of disease among the Natives of this country, some such plan would be found greatly to assist the grand preventive means, the subject of my Theme, the removal of Malaria.

In the Map of the 24-Pergunnahs, which I copied from the Map which Mr. John Masters lent me several years ago, will be seen the Roads and Tanks proposed by that gentleman to be made in the Eastern Suburbs marked in red ink, and it will be observed that this projected Improvement occupies at least half the ground between the Salt Water Lake and the Mahratta Ditch. The Improvements recommended by the Entally Committee were more extensive.

No. VII. *b.*

A. 1.

On the Topography of Calcutta, the Suburbs, and the Salt Water Lake, and Soondurbuns beyond.—1828.

In and about Calcutta among the causes of unhealthiness, are the number of small dirty Tanks, and the large Drains from which the Water does not run off; examples of these may be seen in every direction, but particularly along the Circular Road, the Boitakanah Road, and the Roads in and about Entally and Sealdah. To these may be added the numerous Holes or Tanks of Shallow water which fill in the Rains, and stagnate in the Dry weather. To remove these causes of Malaria, it would appear necessary that the Drains should be kept in a clear state, so that the water should run off at once; and as to the Holes or small Tanks they should be filled up.

On looking at the Map it will be seen, that there is a great deficiency of *Public large Tanks* all along the Circular Road,* and if Tanks of a considerable size were dug there, the

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* As regards the deficiency of public Tanks, I am glad to be able to add the following as a Presentment of the Grand Jury to the Judge, signed by the Foreman, on behalf of himself and the other Jurors only the other day,

"That the Native Inhabitants of Calcutta are, during the Hot Season, most distressed for want of a proper supply of Water for Domestic purposes, and for the extinction of Fires; and that there ought to be at least *Six new Tanks of water* dug on the Calcutta side of the Circular Road, and the aqueduct from the Engine at the Chandpaul Ghaut ought to be carried to each of the said proposed Tanks, and also to the several public Tanks now being on the line of road from Sám Bazâr to Park Street, in order that the said several Tanks may be supplied with Water from the River, &c. &c. *August 25th* 1837."

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soil from them might be used in filling up innumerable Holes and Tanks, and also many Ditches, which are perhaps of an unnecessary depth and width. A plan something like this, Dr. Martin tells me, was adopted near the Body Guard Lines and his Hospital,* with great good effect in lessening the number of sick sipáhís in Hospital. To these causes may be added the great quantity of Trees and Jungle to the Eastward of Calcutta, and indeed throughout the Suburbs, and even in many parts of Calcutta itself; much of this exists in the private Gardens and Compounds of individuals, and is, I imagine, as great a nuisance as it is in Towns in England to exercise any unwholesome trade to the detriment of the health of the Inhabitants; and as such nuisances can there be put down, so ought the nuisance of overgrown Jungle here to be capable of being removed. Much probably arises from neglect, and would be removed without any coercion; example might induce some to remove the nuisance, but there might be others, who might require a stronger stimulus than either example or their own benefit. To meet this, perhaps a Regulation, if necessary, might be framed by Government, which I should think would not be a matter of much difficulty as far as regards the Town, and for the Suburbs I should hope there would be no difficulty. In the Native part of the Town, the *stench* of the Drains and stagnation of the Tanks is a sad grievance. In these *filthy* stagnant small Tanks or Puddles, numerous Natives bathe; and in these you may see filth of every kind; and I can point to such which produce *sickness* and *death* to those who live close to them. The filling up of those

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* Mr. Martin in a printed paper on the Medical Topography of Calcutta and its Suburbs in 1834, gives a further account of the Body-Guard Hospital, and Improvements the Government adopted at his suggestion. He says, the result during the three following years, was a reduction in the frequency and intensity of fever, as remarkable as it was satisfactory. In speaking of the different Villages he says, that one description will serve for all; viz. general irregularity of ground, affording lodgments of various extents for stagnant waters, now very offensive; Drainage every where defective, and good Tank-water scarce. There are also belts of Jungle trees and underwood, obstructing ventilation. In all these villages the replies of the Natives confirmed, what indeed any one could have predicted, as to the general prevalence of remittent and intermittent fevers; he adds, it may be said with truth, that of all the places noticed, there are not six square acres of soil occupied by Natives which do not contain marsh, and other concentrated sources of periodic fevers, which in the course of time establish their inevitable sequelæ of spleen, and fatal diarrhœa—the brief history of the life and death of two-thirds of all the poor Inhabitants around us.

I do most cordially agree in sentiment with Mr. Martin, that, without attention to the state of the Suburbs in the first instance, it is useless to attempt any great improvement within the City, and he considers that for one case of Fever within the City, there are two beyond the Maharatta Ditch. I allude to Mr. Martin's observations and sentiments on these subjects, as confirming those which I had previously expressed in my own papers on the same subjects; and I may add, that the late Doctor Vos in his letter to Mr. Martin's address, says—" The Suburbs require much Improvement, and as long as this object is unaccomplished Calcutta cannot be healthy, it being surrounded with Jungle on all sides except the River. The Suburbs of Calcutta are full of dirty pools, and no sufficiently large Tanks." And he alludes to the continual sickness in most families, except those who live in Upper-roomed houses.

With the same view, I also refer to the observations made by Bábu Ramcomul Sen and Dr. Jackson, to Mr. Martin's address, who remark that the particular causes of fever are :—

1st. Want of Tanks in different parts of the Native Town to supply wholesome water for drinking.
2nd. Accumulation of Filth and stagnant water.
3rd. Shallow Tanks, with Unwholesome water.
4th. Digging Pits and Holes, and leaving them open.
5th. Drains.

And it is further remarked—in the Suburbs of Calcutta the Drains are badly kept, water does not find its free passage in them, and amongst crowded gardens, full of marshy places surrounded by Jungle, the free circulation of air is prevented, while the decayed leaves and vegetable substances thrown into the stagnant water create Malaria, and produce Fever; and it is added, that few of the labourers, peasants, and poorer class of people living in the Suburbs, escape its effects; and even the higher class of people are attacked with it, and a large portion of them fall victims to it. *August 29th*, 1837.

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Holes and making large Public Tanks would be of essential benefit as regards Cleanliness and Health.* Almost throughout the Native Town the Drains are generally of a bad kind, and as regards Drains, the Steam-engine,† now about to be erected at the Bágh-bazár, to water the central Chitpore road, might be made available to fill Reservoirs that might once a day, or probably twice, cleanse the Drains; or it might be desirable to erect more powerful Steam-engines for such purpose generally throughout the Presidency. The filth of every kind found in most of the cross and small roads in the Native Town is a great evil added to the rest, and if the Chokidárs, or those empowered, would oblige the Baboos, and those in large houses, to remove away their nuisance, it would be desirable—Regulation of 1814, enforces this.

The Tatties generally throughout the Native Town of Calcutta and Chowringhee, are much complained of in all directions; and situations of extreme nuisance on this account are frequently pointed out to me. I have found in the Insane Hospital the advantage of sinking this nuisance into deep wells‡, but improvements of this sort, and of so extensive a nature, would rather belong to a scientific Surveyor than to a Medical man, whose province it may more immediately be to point out these various sources of pestiferous atmosphere, and the same remark equally applies to the general Draining of Calcutta.

It is not easy to point out what this Miasma or Malaria is, but the state of the soil has much to do with it; it is known to be formed in Marshy or Undrained spots, in Wet Woods, and in Moist Meadows; and the low and dense brushwood Jungle or thickets of reed or grass, so common in India, being the residence of moisture and decaying vegetation is analogous to Marsh land, and must produce much; but it is well known that Indian Fevers are caught also in Forests, such as the Turraie forest, and many others, but particularly in a most dangerous one near Hoosunabad, and one above Bareilly.

I conceive then, that putting out of question the Soondurbuns, and the *Salt Water Lake*, that the Thickets of trees and Jungle, Weeds, Pools, small Stagnant tanks, and Jheels, which every where abound on each side of the road, down from Chowringhee, Brejeetullah, to the end of Russapaglah, on each side of the Kalighat road on to Tolly's bridge, on each side of Tolly's Nullah, and the road on the right of this Nullah as far as the Insane Hospital, where the eye can hardly find any equality of surface except on the Jheels and Tanks, and where the wild Indigo and *noxious weeds* are growing in all directions—all this being situated South of the Presidency, must be a constant source of disease and disorders, many of which would vanish, if this pestilence could be removed. And if I am not mistaken, I can trace illness from this very source (these weeds, &c.) to certain houses in Chowringhee, where in occasionally uninhabited houses, in the compound, and round the Tanks is to be found Jungle indeed,—which must add greatly to the Malaria which is blown from the Russapaglah Jungles over the Chowringhee part of the Presidency. I have *as yet* excepted the *Salt Water Lake* and Soondurbuns, to confine myself to *Calcutta* and its *Suburbs;* but considering the general healthiness of this Presidency, they cannot be well excluded, and they have been always considered as conducing to the general unhealthiness of the place, the wind coming over such an expanse of *Jungle* and *marsh*. The experience of medical practitioners here confirm this opinion, for it will be generally found, that where easterly winds prevail for some days together a greater degree

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* One good-sized Tank has since been made in the Native Town. *August 29th,* 1837.

† A considerable sum was subscribed for this purpose, but the plan was not adopted, the interest of the money being expended in watering the Chitpore road. *August* 1837.

‡ The same plan has since been adopted in the Jail Hospital at Allipore. *August* 1837.

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of sickness is common. To inform myself, as well as I can, regarding the Lake, I have been through it as far as Tarda, and frequently visited its borders by the several roads leading up to it from the Circular Road; the further half of what appears in the Map as Lake, is now a continued low Soondurbun Jungle from Bamanghatta to Tarda, intersected by channels; and the same kind of thick low Jungle is continued round from Tarda to near the lands adjoining Gurria-haut, on Tolly's Nullah. From inquiries I have made I understand that the water in what is called the Lake, but which may more properly be considered as a mere shallow Marsh, is generally not much more than knee-deep, and it is in many places of even less than that depth. The appearance of grass and bushes growing in the water, shews that it cannot be of any considerable depth, and I am inclined to believe, that the depth of the water generally throughout the Lake, is, with the exception of the Navigable Channel through it, not of greater depth than what I have just mentioned. The water is brackish, but becomes more salt as you proceed from Balliaghat towards Bamanghatta, along the navigable channel which runs through the Lake to that place. No one can doubt that a shallow* brackish or Salt Marsh, extending, as the one in question does, over a surface of many miles,† must be a source of much unhealthiness, particularly in a tropical climate; and that it must produce a contaminated atmosphere, the bad qualities of which must affect the health, not only of those inhabiting its immediate borders, but also those residing in the neighbourhood for miles around it. That the neighbourhood of the Lake is really unhealthy,‡ I believe needs no proof; inquiry amongst the Natives of Balliaghat and other places, similarly situated, would satisfy any person in this respect. He would be told, " the air was very bad," that " the *Salt* air was very bad," and would find, that sickness in those places more than commonly prevails.

I have heard it said, that this Lake or Marsh was capable of being Drained, and the lands redeemed and brought into cultivation; moreover, that it would probably become valuable land for the cultivation of Indigo, Rice, and other products. The question of Draining, however, is one which belongs more to the province of a Surveyor to decide, and upon which I am unable to form any correct opinion. The Channel which runs through the Lake from Balliaghat to Bamanghatta, is bordered on each side with grass and Jungle, and is the only part of the Lake which I understand is used for the purpose of Navigation, and this Channel is obliged to be kept open by means of Dredging Boats. On the borders of it, and indeed on other parts of the Lake, huts are occasionally to be seen, and Cattle grazing in the Jungle and grass in the water; here and there are to be met with lumps of earth above the water, and particularly *small ridges in some places along the edge of the Navigable Channel.* From these circumstances, and from what I have heard on the subject of Draining the Lake, I am rather inclined to think that something might be practicable in this respect, and I believe there are as yet no grounds for supposing it impossible to Drain off the water; or by Embankments, or some other means, to reduce the land, now waste and useless, and a source of disease, into profitable cultivation, and make it at least a comparatively healthy place. I believe that some land bordering upon the Lake, on the Calcutta side, and to a considerable extent,

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* Marshes into which Sea-water occasionally enters, are observed to be more Pestilential than mere Fresh-water Swamps. Vide Dr. Traill's Medical Jurisprudence, page 88.—*August*, 1837.

† Eighteen and a half square miles.

‡ Some years ago 16 Police peons were sent upon a particular duty to the borders of this Lake—every one of them became ill; as many more men were sent in their room; and these were all attacked with disease, and obliged to return.

My informant was Mr. Blaquiere, who saw these men. It has been said that if the Lake was converted into a rice cultivation, it would be as unhealthy as it now is. Quere. Would a double batch of men sent to a rice cultivation become thus diseased?

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has already, by means of Drains and Embankments been reduced from its marshy state, and either is, or will shortly be, in a state of cultivation; which is a proof, that industry may overcome any seeming difficulties; and that at least some parts of this Pestilential Marsh may be brought into a valuable state; and if the whole, or a considerable part was reduced into cultivation, even into Paddy or Rice lands, the situation would become much more healthy, and the whole neighbourhood, including Calcutta, would be much benefited by it. It is true, that as Paddy or Rice land it would still, at certain Seasons, be partially under water, as lands of that description generally are; but I do not think that such lands produce the *same** unhealthy atmosphere as the present Salt and Jungle Marsh

* *Annesley* on Soils and Situations productive of Miasmata, &c.

Page 55.—The copious extrication of unwholesome effluvia from *Salt Marshes* and partial Inundation of the Sea has been long admitted, and has only been disputed by one writer of eminence, who instances, in disproof of the position, the Salt Marshes of one particular District in the Western Hemisphere; but there it is probable that there was some peculiarity in the soil and its productions, which rendered the formation of Malaria impossible.

Page 56.—Experience will prove, &c. &c. when such Soils have been Inundated by the *Sea*, as from the breaking down of Embankments, &c. the formation of deleterious effluvia has become most abundant, and has been the source of a most devastating pestilence. In proof of this, we may mention the noxious situations and *Salt Marshes* at the mouth of the *Ganges*, the *Irrawaddy*, and the *Indus*, and numerous other places in the East. In the North of Holland the fever which was so destructive in 1826, was a very strong proof of the deleterious effect of *Salt Water*.(1)

Page 57.—The effects resulting from the Inundation of the *Ocean* are not perhaps referrible so much to the circumstance of a small quantity of Salt proving a septic, as is supposed by-many; for it seems evident the antiseptic properties of Salt are in proportion to its quantity, and that a small portion will not have a septic tendency, because a large one has an opposite effect. The subject has not received its desired attention; and authors have, in respect to it, been more prone to copy the suppositions and admissions of their predecessors than to examine into the grounds upon which the opinion is founded. *That Sea-water, mixed with Fresh-water and vegetable matter in a state of decay, will increase the generation of effluvia* under the influence of a powerful *Sun*, and render them more concentrated, SEEMS TO BE THE FACT. It has been *repeatedly* presented to *our notice*, and is supported by the *testimony of the majority of observers*. But this result seems to be owing to the quantity of *animal* matter Sea-water contains, which occasions it to *run faster* into putrefaction than Fresh-water, when subjected to a *warm temperature, and kept at rest*. Much is owing to the lowness of the situations where Inundations take place, and the quantity of vegetable and animal matter in a state of decay which such situations contain. The exhalations proceeding from these places, whether within the Tropics or in temperate regions, during warm Seasons, are generally more noxious during very moist states of the air, a condition always present in warm climates; and they are still more particularly *hurtful, when* they have been collecting for a considerable time, owing to the continuation of calm weather, and the absence of thunder storms, or those more violent atmospheric vicissitudes which are so beneficial in sweeping away the exhalations accumulated in low and narrow ravines, and among the *thick underwood of Tropical regions.—August*, 1837.

(1) " The Epidemic which prevailed in Holland, and particularly in Groningen and its vicinity during the summer and autumn of 1826, seems to have been owing to the partial Inundations of the country by the *Sea* during the preceding winter and spring. Through Friesland, and particularly in the Town of Sneeck, observes Mr. Kerchoff, (Journal Complement, January, 1827,) this cause appears to have had a decided influence. Sneeck is a handsome and well-built Town, the Streets are broad—the population in 1825 was 6373, and the deaths were from 10 to 12, monthly. In the autumn of 1826 it became the centre of the epidemic which ravaged Friesland, and in July the deaths were 23, in August 87, in September 80, in October 127, and from the 1st to the 20th of November 62. The water in the fosses of this Town is generally limpid and running, and that which usually fills the adjoining ponds and lakes is equally pure, and suited to domestic purposes. But after the breaking down of the dykes in 1825, and the consequent Inundations, the water became Salt and brackish, and during the high and continued heat of the following spring and summer it became greenish, and so offensive, that the workmen could not labour in the vicinity without being seized with intermittents and remittents. As the summer and autumn advanced the fever assumed a remittent and even continued form, and the effluvia from the soil became more concentrated and noxious, as the waters were more completely Drained off by the continued warmth of the season. At the same time the bad water was used, without sufficient purification, for domestic purposes. These causes, although instanced here with respect to this particular place, were also present in equal force at Groningen and other places in Friesland; the fever which was at first intermittent, assumed a continued type, and, during the exacerbations, the pains of the back and head were increased. In the majority of cases the liver was much affected. In the months of August and September, the fever assumed the character usually presented by fevers in low and moist situations within the Tropics, the circumstances occasioning them being in every respect similar."—*August*, 1837.

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now does, though they may do so in a comparatively small degree; the crop is cut down, and not allowed to rot on the ground, or in the water, as the Jungle does, and the land is clean for many months in the year. If by general Draining, Levelling, removing the neighbouring Jungle, and producing as much as possible a free current of air, the atmosphere we breathe shall be rendered purer, many lives may be saved, and many who are now obliged to leave the place, may be able to remain, and attend to their respective occupations.

Note.—*The above Paper was written and given to the Governor General shortly after his Lordship had sent for me on the 2nd September,* 1828.

(Sd.) F. P. STRONG.

No. VII. *c.*

A. 2.

Continuation of the same subject—Allusion to the Soil around Calcutta—Sir H. East's opinion of the same, after one experimental boring—Remarks on the bad effects of Marsh and Jungle air; allusion to cases and localities—Remarks on Cultivating the Soondurbuns, &c. —1829.

To Major BENSON, &c. &c.

Sir,

In continuation of some Papers which I had the honor to give some time since for the information of the Right Honorable the Governor General, regarding the healthiness of this Presidency and its Suburbs, I have the honor now to submit some further remarks on the same subject.

In my former statement I alluded generally to the various causes to which I was led to attribute much of the unhealthiness of this place, and amongst these were various nuisances, which I took the liberty of pointing out;—such as the great quantity of surrounding Jungle, the numerous small dirty Tanks, cavities, &c. and the general state of the Drainage. I have since gone further in my investigation. This, and practical observation, have more and more confirmed me in the opinion that I have always entertained relative to these several causes being productive of unhealthiness, by contaminating the atmosphere, and generating what is termed Malaria.

That I am not singular in my opinion of the bad effect of stagnant Drains, is evident (in addition to other authorities which could be produced), from a circumstance of late practical occurrence, which I beg leave to quote. It is what lately took place at Gibraltar, where extensive sickness had prevailed; a Dr. Wilson, who was there, speaks of the Augean Drains, and attributes the illness to Malaria. I have appended the short account he gives of it. If difficulties have existed in respect to Draining in Calcutta and its vicinity, I am inclined to suppose that they do not arise from the nature of the soil; and without feeling competent to give any opinion on the practicable part of improving the Drainage, I am not I think going too far in supposing that the new Canal, now being cut, would afford a great means for the Drainage of all that part of the Town to which it runs parallel. This great improvement is now rapidly going on, and viewing it merely in one point—that of the healthiness of the neighbourhood—we have only to look at the broad

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belt of Jungle that has been cut down for it, and the numerous small Tanks which have either been cut through or filled up, to be convinced of its great benefit. Besides commercial and other public advantages, this benefit and improvement would indeed be greatly extended, if the Canal was, instead of stopping at the present Eastern Canal, to be continued round the remaining part of Calcutta, and to join the Tolly's Nullah towards Bhowanypore or Allipore.

Considering that the nature of the soil might have much to do with the dampness and unhealthiness of this part of Bengal, and having for some time past taken opportunities of collecting various Peat earths that abound every where about these parts, I had examined the earth in several places, by boring with a machine to various depths, when my attention was called to the circumstance of Sir Edward Hyde East having, in 1814, made a boring 140 feet deep near the River, in search of a Spring of pure water; he, in a paper which he communicated to the Asiatic Society, remarks, that the different strata through which the borer penetrated have furnished the following observations:—

1st. "The primary object of getting at a Spring of fresh water entirely failed, of which sanguine expectations had been formed by the projector of the experiment, grounded, as it should seem, upon the common opinion that the soil of all the lower part of Bengal was particularly moist, and full of Springs; an opinion, which this experiment, if it can be taken as affording any criterion of the soil throughout the vicinity of Calcutta, has so far happily discountenanced. The first appearance of any damp was at the depth of 71 feet, in a reddish clay with a quarter of sand, and below 76 feet the earth was as dry as before, though the borer must have descended nearly to the level of the Sea, which, as the crow flies, cannot exceed 70 miles in distance, which the fall of the River, commonly computed at one inch a mile, is supposed to be according to its windings.

2nd. "The damp of the climate not being attributable to the moist nature of the soil, nor affected by it, otherwise than as an admixture of saltpetre in the soil may be supposed to have some influence on the exhalations from the surface, must be looked for, principally at least, from causes upon, or above the surface, to the want of a general system of Drainage in a level country, and the luxuriant vegetation, with inadequate openings through the woods for ventilation, which prevent or impede the copious falls of rain at the periodical season, and not unfrequently at other times, from running off properly. The heavy dews at other seasons are not probably more than sufficient to supply the daily exhaustion of the sun, and would rather contribute to the healthiness of the climate. All that seems wanting, therefore, is Surface Draining upon a general plan, and the cutting of broad strait Roads through the woods, as much as possible in the direction of the prevailing winds. The acknowledged improvement of the climate in and about Calcutta of late years, appears to be the natural result of the superior attention which has been paid by the Local Police to these two objects, the benefits of which will be extended with the extended application of the same means."

Years before this Rennel had made similar observations; and since the period of Sir Edward East's remarks, considerable improvements have taken place,—though it is obvious that much yet remains to be done. I concur particularly in his observations about the Surface Draining, and the cutting of the Roads in the direction of the prevailing winds; and I may add, that in two of the borings which I have made at a considerable distance from each other, and one of which was in the New Canal, I have found that at about 70 feet from the upper surface, the yellow clay that was brought up was extremely tenacious and hard, after which water came up to the surface of the bottom of the Canal, but it was of a brackish nature. This circumstance tends further to prove the correctness of Sir Edward East's opinion as to the difficulty of meeting with a Spring of pure water, and argues, that if such is the general nature of the soil, in digging Tanks, no object is to be gained by

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making them of extraordinary depth, under the expectation of meeting with springs of fresh water, but that they must be considered rather as Reservoirs for rain water; and for that purpose, a considerable depth may be proper. But if at a certain depth, say at 60 or 70 feet, brackish water is generally found to exude from the earth, it might not be well to dig through the hard clay which is found to lie a considerable thickness above such brackish water. These investigations seem to prove that the soil hereabouts, which is unquestionably alluvial, does not contain so much moisture *below the immediate surface* as is generally supposed, and the *production of impure air* is most probably from the *surface* rather than from *below* the surface, though possibly in *other soils and climates* it may be otherwise; therefore if a system of Surface Draining, by open shallow Drains, were adopted, the advantages contemplated by Sir Edward East, might be obtained.

I take the liberty of alluding to considerable advantages obtained at Madras by the establishment of a Board of Health, and referring to the recorded opinion of the Justices of that Presidency, in their report at the last Quarter Sessions, of the utility of this Board, and of the improvements that had arisen from the attention of that Government to general points of clearance and cleanliness. If in that place, where they have the advantage of a Sea wind, such nuisances as these alluded to, are felt, it is fair to consider that they will be more felt here, where the vegetation is much more exuberant, and the population greater. I would here respectfully submit, that it is worthy of consideration whether similar proceedings to these of Justices in Quarter Sessions at Madras, might not here be attended with beneficial results, and also, whether a Board of Health at each of the large Districts, or Divisions under the Bengal Presidency, might not be beneficial. It might be composed of the Senior Military, Civil, and Medical officers; but should this not be deemed expedient, a Board or Committee of Health in the Presidency itself might be attended with incalculable advantages. When I first arrived in 1816, the South-east part of Chowringhee was covered with similar huts, and compounds to those alluded to at Madras; at that time I remarked certain well-built houses near those parts were uninhabitable, and the damp and evening mists about them were proverbial. Some time afterwards, those huts were all destroyed, several large Tanks were made, and the land generally levelled for the purpose of building good houses. Rawdon street, Loudon street, Moira and Hungerford streets were finished, and I now observe the formerly unhealthy houses I have alluded to, occupied, and no longer considered dangerous to reside in.*

I alluded in my former paper to the very Jungly, neglected, and irregular state of the lands on each side of the Russapuglah road, leading from Birgetallah, Chowringhee, down to the place where the families of the Mysore Princes reside. I am every year borne out in forming the same opinion, and coming to the same conclusions I have there expressed, by my observation and attendance upon the Princes. I invariably find that when the wind blows over these Jungly and Swampy parts, towards their habitations, fever, and that often of the most virulent kind I have ever met with, prevails, and this more especially where the houses are low, or surrounded with marshy Swamp or Jungles, which is the case with several of them. There are some others, where the heads of the family have built their houses, three and four stories high, in the highest apartments of which they have their Zanána, and here they rarely suffer; but I know some lower-roomed houses, where the grounds are kept clean and airy, where they are also healthy, although perhaps not quite so much so, as in the higher houses. With the exception of accidents which occur now and then, and hydrocele, to which this family seem peculiarly liable, and which

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* Huts are now rebuilding, and the place getting filthy.—*August 8th*, 1837.

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often requires operation and attention, I should consider the Princes generally healthy, their usual complaints being remittent and intermittent fever, and its consequences, such as spleen diseases, affections of the liver, and other visceral obstructions; and although I think I am correct when I state, that since I have had Medical charge of these numerous families, now nearly nine years, I do not know of any one fatal case of cholera morbus, or one fatal case of small-pox having happened, (though these disorders have yearly carried off many in the adjoining villages;) but after the last rains I had a considerable number of spleen cases among them. I expect these families will now be tolerably healthy till the rains set in, when those in Jungly and damp situations must be expected again to suffer. I have mentioned this regarding the Princes, because the facts I think go far in confirmation of my main arguments, the unhealthiness of Jungle and Swamp.* It would be useless to enter into a detail of the particulars, which I could easily do, to prove the unhealthiness of numerous localities in and around Calcutta; one however I may allude to,—it is the case of the late Rev. Mr. Mosquito, a Roman Catholic clergyman, who lately went into a lower-roomed house at Siáldah in the Suburbs, which had a small compound covered ancle deep with dead leaves of trees, and close to this compound was a large tank, then filling up with stable straw and other filth. His fever was of the most virulent kind, and ended fatally last Friday the 17th instant. This particular cause of illness I believe, to be very common, which makes me thus anxious to bring it to the notice of the Right Honorable the Governor General, and I may be allowed briefly to mention, that I have visited many of the Villages bordering upon the Lake, and that I find the Inhabitants in point of appearance and health, to correspond very much with the state of those people who inhabit Malarial and Marshy lands in various parts of Europe and America, as pointed out by well-known authors. Since my remarks about what I had seen of the Lake I have been occasionally there, and I found that much of the land, which during the rains was covered with water, has since been dry, with Jungle growing upon parts of it; the tides have now risen higher than they were two months ago, and have covered at high water part of the land which had been left dry; these lands, being daily alternately wet and dry, must be a constant and plentiful source of Malaria, and fortunate indeed is it for the Inhabitants of Calcutta, that these Marshes are not situated South of it, instead of where they are. From the borings I have made in many parts of them, I should say that it would prove a most productive soil, fully equal to any about here. A moderate portion only of sand is met with, until you go to quite the other end of the Marshes, near Bamanghatta, where, more sand begins to appear. In parts where I bored deep, I found in my course the same charred, or peaty earth, to be found every where about Calcutta, and again below this a very tenacious yellow and slate-coloured clay. Of the existence of an ancient Forest, all now covered by earth, there is no doubt whatever, as almost every where, about 20 feet deep, large timber trees are found in a state more or less of decomposition, but the superfices of the Salt Marshes, and down to 12 feet, is certainly composed of an earth well calculated for embankment.†

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* Since writing this, Prince Sooroorooden has been carried off by diseases, I believe entirely produced by the filthy state of his habitation—he allowed the most noxious Jungle to grow all round his house up to the very doors and windows. I could not prevail upon him to remove this, and I have taken several gentlemen to the spot to shew them what a magazine of Malaria existed, and how wonderful it was that life could be preserved within it. His diseases were fever, neuralgia, latterly partial insanity, and he died in an apoplectic fit.—*August*, 1827.

† Since writing this, an embankment has been made permanent on the Western side of the Navigable Channel, nearly half across the Lake as far as the Byamcarl; the lands, beyond are tolerably high, filled with Jungle.—*August*, 1827.

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These remarks bring me to the Jungle and Waste Lands beyond the Lake, and to the foregoing observations, I hope I may be allowed to add a few remarks on the subject of Cultivation. From all the information I have obtained, I am led to believe, that these *Waste Lands in the Soondurbuns are capable of being made to produce a variety of crops.** Some Coffee plants which I gave to a cultivator of Soondurbun lands last year and the year before, and which were planted out by him on the cleared lands, are, I am informed, in a thriving state; it may therefore be worthy of consideration, whether, if this plant is found to flourish, it does not hold out an additional encouragement to the clearing of these Jungle lands. I am aware that various opinions have existed respecting the cultivation of Coffee in this country, and that its success has been thought doubtful; several experiments have however succeeded, and the Coffee is considered of a fair quality. I have myself made the experiment to a small extent, and judging from the appearance of the plants in a piece of ground of about 10 acres, I have every reason to believe that the cultivation of Coffee here will ultimately succeed. I sent a thousand Coffee plants as far up the country as Moradabad, upwards of three years ago, and the last accounts I heard of them were very favorable. *Cotton* is perhaps another article that might be produced to a great extent in the Soondurbun lands. In an article in the Edinburgh Review, (No. 91, June, 1827, page 25,) *on the rise, progress, present state, and prospects of the British Cotton Manufactory*, it is stated, " that previously to 1790, the supply of raw Cotton for the British manufacture was principally derived from the West Indies and the Levant. But after the termination of the American War, Cotton began to be cultivated in Carolina and Georgia, and has succeeded so well, that it now forms one of the most valuable productions of the United States. American Cotton is generally known by the name of *Sea-Island*, and Upland; the former is the finest Cotton imported into Britain. It grows on small sandy Islands contiguous to the shore, or on the low grounds bordering on the Sea. The Upland grows at a distance from the coast." This article was written before the late American tariff, which has naturally led to discussion upon the cultivation of Cotton, and it has been considered that it may be cultivated with great advantage in this country to almost any extent, and of a quality not perhaps inferior to that produced in any other part of the world.† From the description given in the Edinburgh Review of the kind of land on which the finest Cotton grows, it appears in some measure to *assimilate to the Soondurbun lands.* I am told that the Bourbon Cotton grows well at Diamond Harbour, and previous to the last rains, I had some rows of the Bourbon cotton trees in a garden raised from the seed, and thriving abundantly, but during the rains they were so very exuberant that I cut them down; two or three only were left, and although entirely neglected, and most of their branches cut, they soon came into blossom and produced cotton, which I neglected taking care of, but I got from them quantities of seed, which I have given away.

From this trifling experiment however it is evident that the plants would thrive here, and it might perhaps be cultivated to a great extent in the low lands of the Soondurbuns. Should these lands become cleared, the cultivation of Sugar-cane on them may become an object of importance. It was observed by a Mr. William Fitzmorice, (who

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* American cotton grown in these lands, and produced at the Agricultural Society, has been considered excellent.

† On the 20th of October, 1829, the Governor General expressed a desire to assist the Agricultural Society of India to promote the cultivation of superior Cotton and Tobacco, and the Court of Directors in 1831, sent out American Cotton Seed, and Government sanctioned an experiment at Akra in the Agricultural Society's ground, the particulars of which will be found in their report published in 1835. The Society also sent American seed to various parts of India, and the samples of cotton sent by several of the experimentalists were excellent.—*August*, 1837.

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had been in the West Indies many years,) in a statement he made to the Honorable the Court of Directors, and which he printed in 1793: "That the more he saw of this luxuriant soil, the more he was convinced that they might annually import from Bengal any quantity of Sugar, and a proportionable quantity of Rum of a superior quality, without interfering in the smallest degree with the present cultivation and manufactories of Bengal. Indeed that the waste land occupied by the tigers, between this and Injella would produce nearly as much Sugar as the Island of Jamaica." Mr. Fitzmorice, from his printed work which I have, appears to have been practically acquainted with the cultivation and manufacture of Sugar, as it was carried on in the West Indies, and was therefore probably capable of forming a correct opinion on the subject, as well as on that of the cultivation of Coffee, of which he also wrote, but which Coffee cultivation has only (so far as I can learn) been attempted of late years, though the plant has long since been found to grow well in private gardens; much of this land to which Mr. Fitzmorice alludes, has since been brought into cultivation. Rice is, I believe, the principal crop, but of the vast tracts which remain in a state of waste Jungle on the East of the river Hoogly, and towards the Soondurbuns, much might no doubt be made productive, and if Sugar should be found to thrive on those lands, it is evident that it might be cultivated to a great extent.

You will oblige me by laying this paper before the Right Honorable the Governor General, at his Lordship's leisure.

(Signed) F. P. STRONG,

April 23rd, 1829. *Surgeon to Suburbs of Calcutta.*

No. VII. *d.*

A. 3.

Continuation of the same subject—Boring for Artesian Springs advocated—Success in Europe of late years, giving the authorities—Further remarks on the Soondurbuns, with quotations from Baron Humboldt on the advantage of Civilization, and the Abbé Man on the healthiness produced in the Netherlands by Clearing, Cultivation, and Civilization.—1829.

To MAJOR BENSON, &c. &c.

Sir,

In the Papers which I had the honor to submit some time ago for the information of the Right Honorable the Governor General, I entered into an explanation of what I conceived to be some of the principal causes of unhealthiness in Calcutta, its neighbourhood, and the lower part of Bengal. In doing this I was naturally led to make some remarks upon those great sources of Malaria, or impure and unwholesome air, the Salt Water Lake, and the Jungly Soondurbuns adjoining; considering that the Draining of the one, and the Clearing of the other, would be a great Public benefit, if even done only with a view of removing such causes of Malaria, and consequent illness.

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In carrying into effect such measures, one most important *necessary* of life must be obtained, or else it is to be feared that any Improvements which may be attempted will proceed very slowly, and cannot ultimately be carried to a considerable extent. The article to which I allude, is a good and sufficiently abundant supply of fresh Water *fit* for drinking.

This is an article even much wanted in Calcutta itself, particularly during the dry and hot months; and much illness amongst the Natives has, and no doubt correctly, been attributed to their drinking *dirty, stagnant,* and *putrid* Water. The supply of *good* Water might, I am strongly inclined to hope, be much increased in and about Calcutta, and that by the simple, speedy, and comparatively trifling expensive plan of boring;* should this plan be tried and found to succeed here, it might probably meet with similar success if tried upon any of the cleared lands, or upon the Salt Water Lake, when Drained.

My hopes of success are in a great degree grounded upon the examples of boring which have taken place in England, where this mode of obtaining a good and constant supply of fresh water has lately been much resorted to, and has met with the greatest success, not only in London and its neighbourhood, but in the lower parts of Lincoln, Kent, and other fenny Districts.† In some of these, where the Inhabitants and their Cattle suffered much from the want of good water, the evil has lately been removed, where this essential necessary of life has been supplied by means of perforations made to a great depth in the soil by boring with an iron auger, so as to reach and bring to the surface the deep seated springs.‡ To some of the instances I beg leave to refer. Borings which have been made from 200 to 400 feet deep, have been found to cast up from 15 to 20 gallons of soft and remarkably pure water per minute, which without the use of Engine or Pump will rise from 20 to 30 feet above the surface up a tube or guide-pipe.§ Wells have been bored at Tooting, Mitcham, and *Merton,* in Surrey;|| one at *Merton* is said to cast up 200 GALLONS of water a minute,¶ and one at Tooting nearly 100 gallons. At Leeds 100 yards deep has been bored for water, and cast-iron Pipes used for conducting it.** Some partially unsuccessful experiments have been made in chalk.††

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* From M. Arago's work on Artesian Springs, 1834-5.

Issues from principal Fountains.

St. Andrè nearly two tons per minute.
Bages, 333 gallons per minute.
Tours, 237 ditto ditto.
Merton, 200 ditto ditto.
Rivesalte, 176 ditto ditto.
Lillers, 155 ditto ditto.

Depths bored.

St. Nicholas d'Ailermont through 7 sheets of water 1,030 feet.
Geneva, 682 ditto.
Suresne, 663 ditto.
Chiswick, 582 ditto.
Bethune, 461 ditto.
1834 M. Champaiscan, 275 ditto.

† Edinburgh New Philosophical Journal, December 1828, p. 170.

‡ Mechanics' Magazine, vol. i. p. 293.

§ Ditto, vol. ii. p. 31.

|| Since my writing this, M. Arago has particularly alluded to *this* boring.

¶ Mechanics' Magazine, vol. ii. p. 60.

** Ditto, p. 382.

†† Since this, several successful operations have been performed in chalk.

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But water has been obtained at Sittingbourne, in Kent (in which neighbourhood it may be remarked, that the land is level and low) after boring 336 feet. In Bedfordshire 400 feet, and in Surrey near Dorking, 440 feet in depth have been bored and water obtained.* At Hammersmith, boring is said to have been much practised lately. The water obtained there, which was of a superior quality, and the supply regular, in some instances 200 or 300 gallons per hour, but in no case is it said to be less than 80 gallons per hour, and the depth bored has been from 300 to 380 feet before the water was found, after which it has run over different heights above the surface, according to the strength of the spring. In the Duke of Buccleugh's grounds at Richmond Hill,† (where an excellent apparatus for perforating the different strata of the earth is said to have been used,) after boring 252 feet, a supply of most excellent water has been obtained, yielding 13 gallons a minute, and rising, as in a Fountain, 24 feet above the surface of the earth. These examples not only shew to what extent boring for fresh water has been practised in England, but it will also be seen from them, that this method has been successfully tried in both high and low situations, and through various kinds of soil. I will also add a quotation from a work apparently of much practical utility. In Loudon's Encyclopædia of Agriculture,‡ p. 671, it is said there are "borings in Middlesex and Surrey which afford a continuous and abundant flow of water, equal to 8 gallons per minute. A very copious Fountain which rises twenty feet above the surface, has lately been obtained by the same means in the grounds of Ravenscroft Park, the seat of G. Scott, Esq. near Hammersmith." Indeed there can be little doubt that in the majority of situations, not only in Britain but throughout the world, water might be found by boring or digging, down a few scores of feet. The expense in England, as mentioned in the same work, (p. 671,) is stated to be equal only to one-eighth that of well-digging, and it is remarked, that "the advantages of flowing springs of good water, which by these means may always be obtained on the sides of roads, and in a variety of other places where water is not at present found, are incalculable, the cost very small, and the operation easy and expeditious."

If the advantages are so incalculable, and so easily obtained in England, it must be obvious that they would not be less so in a Climate like India, and particularly in this part of the Country where they are so much needed, and where, although the water of the Hooghly, as far down as Calcutta, may be tolerably good, during most seasons of the year, and tolerably good water may be preserved in Tanks, yet the supply often becomes scanty, and when the Tanks are low, brackish and bad. Boring, if found successful, as I think it would be, is therefore a matter of more importance than it may at the first mention of it, appear to be. In the Fort, in particular, it might be found to afford that supply of water which all attempts to obtain have (I am told) hitherto proved unsuccessful and expensive, the wells being all brackish, and the Puckah-built Reservoir, made for the purpose of retaining a supply of rain water having, after repeated expensive repairs, been

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* Mechanics' Magazine, vol. v. pp. 230, 232, 258, 315, &c.

† Ditto. ditto. vol. vi. p. 167.

‡ In this work will also be found an interesting account of the mode of raising Lands near the River Humber by Warping, or letting in the River water, and allowing the warp or mud to settle. By this method Lands have been fertilized, and raised from 6 to 16 inches in the course of a year. An article also in the Mechanics' Magazine, vol. — p. 99, gives an account of this method of Warping Lands by the water of the River Ouse, and speaks of raising Lands near 3 feet in the course of a year. The water of the Hooghly containing a much larger portion of mud, might perhaps be applied to the same useful purpose of raising the Soil of the *Salt Water Lake*, or other neighbouring low Land.

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found incapable of holding water, and its use for that purpose being therefore discontinued. Several borings for fresh water have also been made here, and amongst them, some in the Fort, and the only reason why they have not been successful is, I believe, on account of the inefficiency of the boring apparatus, and its not enabling those, who have made the attempts, to go sufficiently deep. In two borings made in the Fort in 1820, they were not able to penetrate deeper than 122½ and 128 feet: in both these attempts there was no indication of fresh water, but the earth brought up was occasionally damp and moistened with water of a saltish taste; a great deal of stiff clay was met with, and in both cases the *rods broke* and remained in the ground. The deepest boring I can find an account of, is that given by Sir H. East to the Asiatic Society in 1814, and that was 140 feet; no *fresh* water was found, and here the *rods broke* and were left in the ground: the only other accounts of any boring I can find was in 1804-5, and 6,—wells from 20 to 40 feet deep having all proved so brackish as to be unfit for drinking. These borings of 1804-5, and 6, which make four in all, were undertaken for fresh Springs. In the first of these Borings, after surface mould, sand, &c. the borer passed through hard clays with kunkur; it penetrated to 75 feet, when the water rose to the height of the water in the adjoining wells; it was analysed by Dr. Hunter, he considered it unwholesome, as containing a very large quantity of common salt, muriate of magnesia, and clay.

In the second the same sandy clays, kunkur and white and yellow sand, presented themselves at 70 feet: the borer was brackish at 81, and at 101 feet the rods came up nearly dry. A well of tiles had been made round the borer for the first 30 feet, and the water rose into it within 7 feet of the surface, fully four feet of the ground. At this place the ground was artificial above the general level of the country. During the whole dry season the water only subsided in this well 3 feet, and was on the 3rd June, 1805, only 10 feet below the surface, whilst the water in wells at a little distance was 30 feet below it. Here the lowest depth was 119 feet; coarse-grained sand was found, and the soil was very hard, *the borer broke,* and was not recovered. The third was in December, January, and February, 1805-6; similar earths were obtained as above, and from 114 to to 127 feet was found fine yellow sand, coarse sand, and very hard earth—here *the borer broke and* 91 *feet of rods were lost.* At 65 feet the water was brackish, but the deeper water rose to within 4 feet of the surface, and was well tasted. The fourth attempt was in March, April, and May, 1806. Similar earths presented, very hard, from 120 to 127½, yellow clay, sand and yellow sand; here the auger *was* partly *broken,* the edges were found sharpened like a knife. It was remarked that the water at 66 feet appeared tasteless, probably owing to the heavy rains that season in March, which had made the water in all the wells tolerable.

The late Mr. Jones, a person who was well known as having opened the Burdwan Coal Mines, made a boring, and found the same earth and clays, but he did not go beyond 70 feet deep; here he found kunkur, clay, and yellow sand, and he says at 70 feet—through a stratum of red coarse sand—issues a spring which is acted upon by the tides in the River. The borings I have made, have been comparatively trifling, for want of proper apparatus. I however bored down to 40 feet near the west margin of the Lake, where I found very stiff dark clay, and at the bottom some hard kunkur mixed with it.—As I mentioned in my last paper, I bored at the bottom of the Circular Canal, and found water at the depth of 70 feet from the upper surface, which rose 50 feet, and formed a Pond, which was banked in at the bottom of the Canal. This water appeared to me and my friends brackish, but on its first appearance the labourers drank it, and said it was good. At this place the clay, which is of great depth, and in parts beautifully yellow, and containing kunkur, was so very stiff, that at 50 feet, a large and strong auger was twisted in a most extraordi-

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nary manner, and two Europe-made strong Iron Hooks were broken in extracting the rods, which was done by means of a strong gin and windlass.

In a Garden in the Circular Road, about two miles from the above place, I bored through very stiff clay to 70 feet deep, and came to some kunkur, and I suspect other harder substance, which prevented my getting further, and I found the auger much scratched and polished.

At Russapaglah I could not penetrate deeper than 70 feet; at this depth I applied a smaller auger to the bottom of the larger rods, with a view to perforate where the large auger failed, but this broke, and was left 70 feet in the ground. In these borings I found myself much disturbed by the frequent falling in of sand from the upper strata, and I had not a cast-iron tube to prevent it: such will be necessary in any future borings, and a proper frame-work, and mechanical means for raising the rods will also be required.

I am told that there are in Fort William different sets of boring instruments sufficient to go a depth of 600 feet or more, and that they are of greater strength and excellence than those used in 1805 and 1820; but a gentleman who has lately arrived from England informs me, that a newly invented borer is now in general use, and much approved of.

Having given His Lordship a detail of the Plans which I respectfully suggest might be adopted to obtain a supply of fresh water, I also take the liberty of mentioning a few circumstances of information which I have picked up in the course of my inquiries relative to the Soondurbuns; as the circumstances tend to support the principle which I laid down in my former communication of the prevalence of Malaria in all Jungly, Marshy, and Ill-drained situations, and of its effect upon the Inhabitants of such places.

Baron Humboldt gives Tables to prove that in certain places the duration of life has been greatly prolonged by attention to cleanliness, improvements, and civilization. A little attention and inquiry will, I believe, go far to prove that there is much room for such change amongst the Natives of Bengal, but more particularly amongst the Inhabitants of the small and thinly scattered Villages in the Soondurbuns, who I am assured are a most wretched and short-lived people, continually suffering from poverty, and want of cleanliness and civilization, and from disorders produced by bad air generated in the Jungles surrounding them. Numerous inquiries I have made among intelligent Natives confirm this, and although gentlemen who have passed through the Soondurbuns may differ a little in this opinion, it is not to be supposed that their curiosity has led them to visit the villages in the interior, or to make inquiries of such a nature. An intelligent Native, who has much experience of the Soondurbuns in those lands considerably South of Tarda, has assured me repeatedly and most positively, that it is his belief that scarcely one in ten of the Villagers escape Fevers during the months of July, August, and September. The Villages he says, consist of 50, 100, or 200 people, including men, women, and children. They have their Native Doctors, but many die annually of Fever, and the spleen disease prevails very much among all, old and young; these opinions apply to the Inhabitants born and always living in these Jungles, whose constitutions are known to be more capable than others of resisting the poison of Malaria. The Darogahs, Chaprassies, and Servants employed by Government in the Salt Department* are sooner attacked, and when ill they always obtain leave to go to their homes. The Villagers are generally Salt Molungies, Wood-cutters, Boatmen, Fishermen; some shoot game, others collect wax and honey, and others spin and

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* The Government having lately removed the Salt-works more to the Southward, has already been found beneficial to the more Northern Grantees, as the Salt Molungies have willingly become Agriculturists; and it will be seen in the Map that along the line of the new Navigation, running direct Eastward from the Lake, a very great deal of Jungle has been cleared away.—*August* 1837.

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make coarse cloth for the villagers. Of the little land at present cultivated, I am informed rice is the chief produce, and grain, cullie, and other vegetables grow about the villages, in all which there are Tanks: without a Tank, my informant assures me that no husbandman will settle to work, but wherever a tolerable Tank is made, that of itself will bring Inhabitants. I do not believe that any Europeans could live in the interior of the Soondurbuns as they now are—but were it possible to clear them by cutting down and cultivating from their external extremities, and go on gradually towards the interior, and if the land were well Drained, I see no reason why these parts should not be as healthy as any other place in Bengal. With regard to the external clearing, I allude more particularly to the thick and low Jungle bordering upon the Salt Water Lake, and which, from all I can learn, is more productive of Malaria than the forest Jungle towards the Sea. If I recollect right, I think Messrs. Schalch and Morrieson, when Surveying the Soondurbuns found it so; the latter in particular, as he had a predisposition to fever, and he found in the deep broad Rivers, where the timber trees around him were high, admitting wind, and where low Jungle did not prevail, that himself and his servants were well, but when he approached towards the Tarda low Jungles, himself and his attendants suffered. I have heard of one respectable country-born gentleman, who by clearing with great industry and assiduity an extensive tract of land beyond the lands I have been speaking of, fell a victim to Malaria. Another, who has cultivated and cleared a good deal of Jungle lands between this place and Tarda, is constantly suffering from fever, though he visits his grounds only one day at a time, and that only two or three times a month. He employed as an Overseer a healthy Portuguese, but he died of fever before he had been there two months.

I may here mention as regards fresh water, that this latter cultivator informs me, that, in March 1827, he dug a Tank on a high spot, in which he found a Spring perfectly pure, which filled a place walled in to retain the water about two feet high, and the water continued at the height, although the two adjoining settlements, and all the passengers, to the amount of some hundreds, went to this well daily, and if it did sink a little in the day it was sure to fill up the following morning. He made it into a Tank of 10 cottahs, and it continues to supply all the neighbourhood, who without this, would have to go a distance of 10 or 12 miles for Water. He also says, that near a Village called Narainpore, there is a fresh spring, about three feet from the surface, but such was the idleness of the villagers, that they would not dig a Tank; and when he asked them why they did not prefer living upon the higher ground on the river side, they said, they were afraid of being plundered by the boatmen, which is a common occurrence, and he tells me that no Native Moodie or Merchant dares to settle any where except near a Company's Thannah. This individual says, that he finds very generally upon spots a little raised, a simul or cotton tree, which makes him think these parts were formerly inhabited; and the other gentleman found an old house. I believe also, that the remains of old Tanks are here and there to be found:* upon the whole, I have no doubt that if boring for water in these parts should be found inexpedient or inconvenient, that it can be collected and preserved in Tanks, at least as good as such water generally is about Calcutta, so that the want of water should not form an objection to the clearance, and ultimate cultivation of these Jungles, which are so close upon Calcutta. But the boring appears to me to be a preferable mode, as being cheaper, more expeditious, and, as by going to a much greater depth than can be gone in Tanks, the probability of getting pure water, and a constant supply is increased.

These Soondurbuns—unlike the Campine of Brabant, in the North of the Netherlands,

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* Since this period about 1,00,000 biggahs have been cultivated, and in all directions the same proofs of former cultivation appears.

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which the Abbè Man states, "originally consisted of sand, covered with heath, interspersed with Lakes and extensive Marshes, and here and there with woods of fir, and which tradition reports to have been once a part of the Sea, and unlike the arid wastes in some parts of India,—are already fertilized in the highest degree by the decaying vegetation of years, and are, I respectfully conceive, calculated to produce a new and vast revenue to the State after a time, *and when a Scheme* shall be adopted that shall induce labourers to commence this work to a considerable extent;*† for it is not because the lands are barren that they are uncultivated, but chiefly because the air, now poisoned by the overgrown Jungle, is inimical to life, and every year's progress in the removal of this evil adds, in my humble opinion, most materially to the general health of the country. Even the poor Campine of Brabant, after partial failures, is now stated by the above cited author, to possess many extensive tracts well cultivated, and is covered with villages, well-built Houses and Churches. No doubt much of the country has been cultivated since the period at which Lord Cornwallis remarked, that he might with safety assert, that one-third of the Company's territory in Hindustan was a Jungle, inhabited only by wild beasts. We know of Jungle as near the Presidency as Sooksagar, under European management, having become invaluable land, but in the immense forest Jungles, and uncultivated tracts of Hindustan, it is not impossible that a field might be opened in which the Natives, and perhaps others, might raise for themselves an abundant supply of the necessaries of life; the field appears inexhaustible, and would be employment for thousands, while the cause of much disease and sickness (both among Mankind and Cattle), would be gradually diminished; for it is ascertained that in those years in which Malarial endemics and epidemics have prevailed, epizotic disorders have prevailed amongst Cattle. Without going into ancient authority, a late writer, Dr. Macculloch, states it as a general fact, that Cattle or animals of differnt kinds do become sickly or diseased in the same situations which produce the diseases of Malaria in the human race, and that the consequences are as resembling, or analogous, as they could be under the differences which exist.‡ He states these facts to have shewn themselves in Egypt, in Hungary, in St. Domingo, and Gaudaloupe, as well as in France at Rochelle, and in Auvergne and Raussillan, and alludes to that particularly pointed out by Bailly, of the year 1812, at Arles, and adds that analogous observations have been frequently made in Italy; and not to quote more than is necessary, the years 1711, 1738, 1745, 1772, 1783, and 1795, are among those which have been particularly recorded for epizotics among Cattle, each of them being also noted seasons of epidemic fever, or of the prevalence of Malaria; and that further they all occurred in the months of August, September, and October, and were also confined to the Marshy or unhealthy districts. I am acquainted with some Indigo Planters, who have remarked illness and mortality to prevail among Cattle in times when Cholera Morbus has scourged the land, and I doubt not that there are many persons in

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* If the money expended in clearing and cultivating Saugor Island had been expended on Land South of the Lake, the result, I humbly conceive, would have been most advantageous to all the parties,—and quite different to the result of the Saugor Experiment; while Improvement and Healthiness East and South of Calcutta would greatly have increased.—*August* 1837.

† Grants were made in 1829 and 1830 to numerous persons about Attara Banka, to the extent of 500,000 biggahs, about one-tenth of which is now supposed to be in cultivation, in spite of the Agency failures and the dreadful Inundation in 1833; however, several Grantees have done nothing, and the five years having long expired the land is resumable by Government to give to others who will clear it. At this time, October 1836, several Pilots, who have cultivated several thousand biggahs near Attara Banka, expect as good a season as they had last year, which was highly satisfactory to them.

‡ Macculloch, p. 453. Although not noticed by Dr. M. another ancient author, Livy, remarks, that in the same years in which epidemic "*pestilences*" appeared among the people, there was also a great mortality among the Cattle.

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Bengal, who have remarked the same thing. I myself observed the same in the neighbourhood of Dacca some years ago.

The last year has been more healthy than any I have known,* and is the first year since I have been Surgeon of the Suburbs that I have not had an additional number of Native Doctors, 20 or 30, stationed at different posts with medicines and instructions to administer to every case as quickly as possible among the Natives, and I believe Calcutta itself has equally escaped the scourge this year; certainly Calcutta and the Entally Suburbs have been generally more healthy than usual. With my respectful apologies for the length of this paper, I conclude by alluding to one or two localities, particularly the Western end of the old Entally Canal, as being always in a filthy state. It was only early last week that I was called, in consultation with another medical gentleman, to see a child dangerously ill in the house exactly at this end of that Canal. My professional friend now informs me that the child is doing well, but that the father and mother have since been both seriously ill, that the latter was delirious, and for some days nearly dying, they have quitted the house; and such is the nuisance here, that a gentleman and his family have been obliged to quit the very next house to the one alluded to, which is only just behind the Marhatta Ditch, opposite the Dhurrumtollah. As the first step towards eradicating an evil, should be to ascertain its cause with as much certainty as the subject will allow, in order to judge of the capability of applying a remedy by its removal, so I have little doubt, that upon examination and inquiry, the causes of unhealthiness of particular situations in the Town and Country might be readily traced, and in most cases removed, without so much difficulty as might perhaps be expected. It is not to be wondered at, that particular parts of the country or the Town should be unhealthy, if in the one case they be covered with Jungle or Swamps, or in the other they abound with Nuisances which equally *contaminate* the air. Pure *Air,* as well as pure *Water,* is an indispensable *requisite* for Health, but it is impossible to look at the stagnant *pools* of water, the *dirty* ditches in the Native part of the Town, and particularly at the low ground within the Strand road, from where the Hindu bodies are burnt, almost up to the new Mint, which ground is in many places covered with stagnant filthy black water, into which stable dung and other filth is thrown to fill it up, and not to be convinced that such places must make all others near them more or less unhealthy, while there can scarcely be a reasonable doubt, that if these causes were removed, the air would be more pure, and the situations now affected by them equally healthy with the best parts of the Town.

23*rd July,* 1829.

No VII. *e.*

A. 4.

Topography of Suburbs generally,—1830.

Many localities have been pointed out to me as unhealthy, and the filthy state of the Músulman Burying-ground in the Circular Road, is considered particularly so, as making Cassiah Bagaun, very unhealthy; it is surrounded by broad ditches of stagnant water, filthy to an extreme degree. Different parts of Tiljullah and Entally are also well known as unhealthy, and certain particular houses are considered uninhabitable. A few years back a great number of poor were turned out of grounds† purchased by the

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* In the early part of 1828, there was a good deal of fever in the Entally Suburbs for a short time.

† Short-bazar grounds.

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Lottery Committee, and they built their huts in a particular part of the Eastern Suburbs,* on the other side of the Circular Road, surrounded by Jungle, and badly Drained; so great a number died of cholera, that it was found difficult to dispose of the dead bodies; this was after a sudden change of the weather, but these new Inhabitants, who had located upon a mere jheel, suffered much more than the Inhabitants of the surrounding neighbourhood. The small houses occupied by poor Europeans and Christians of colour, near and on the banks of the old Entally Nullah, are dreadfully unhealthy;† and people are constantly obliged to quit. Continuing along South of the old Nullah towards the Lake, there is a great proportion of ground entirely neglected and uncultivated, and this sort of ground is to be observed here and there, among garden ground, filled with high trees, the mangoe, jack, &c. and much of this in a filthy state; then you come upon low rice fields, and then the borders of the Lake appear. There are to be observed the remains of several old roads made by the late Mr. John Elliot, but most of these are so covered with Jungle, their ditches filled up, bridges broken, and the Jungle so impenetrable, that it is impossible to traverse them; the Eastern Suburbs I now allude to, must, at a former period, have been in a very superior state to what they are now, and there are several old brick houses, chiefly Native, and apparently deserted, which go to confirm this fact. In the South, towards Balleegunge, and near the rice fields, the grounds about the villages present numerous excavations of earth, taken for the purpose of brick-making;‡ these being left open, all sorts of nuisances collect in them, but more particularly the leaves of trees, and these decomposing with water and heat, must afford a rich production of Malaria. Still further South, Balleegunge is Jungly and badly Drained, and Bhowanipore and Russapaglah present a continuance of the same evils, many parts looking more like Soondurbuns, than Inhabited Villages.

Then going back, and looking to the North of the old Entally Canal, the same description applies, the same obliterated roads which formerly ran North and South in the direction of the winds, and which were broad and *once* had good ditches and bridges, all are now useless, and covered with Jungle, the habitation of jackals and snakes; and the same belt of Jungle and Villages is continued towards the Dum-Dum road.

This constant source of contaminated atmosphere all *round our City is sufficient to produce disease, however cleanly we may be within;* but *Calcutta itself,* has not much to boast of in that respect, although it is decidedly much more healthy than formerly, even within my recollection and practice here. The opening of Roads by the Lottery Committee over parts which I have often traversed when in their unimproved state, has evidently produced a healthiness and cleanliness before *unknown,* and this *fact* goes far to prove what *good* may be done by the *free* admission of the prevailing Winds, by Cleanliness, and by Surface Draining. In the City, and in the back lanes of Chowringhee, the Circular Road, &c. the Bazars, which have sprung up irregularly, have become an intolerable nuisance, which ought to be abated.

The Drains all about Colingah, and towards the Circular Road are bad generally,—currents of water meeting and running in all directions. Broad roads, with good Drains should be continued from the Circular Road in the direction of the plain,§ which is a Rice

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* Marked on the Map *Curria.*

† Since this was written, a Mr. Ward, the senior clerk of the Sudder Board of Revenue, who I had often advised to quit his house, which was on the banks of this Nullah, has fallen a victim to Malaria. He was naturally a very healthy, stout, active, and strong man, when he went to reside on this spot.—*August* 18, 1837.

‡ I hear that there was formerly a Regulation which prevented Brick-making on this side of the River, and that formerly all the bricks were made on the other side of the Hooghly.

§ Formerly there was a very long ditch, which ran out far towards the Lake, but it is now nearly obliterated. This was brought to my notice by Captain Jenkins.

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cultivation towards the Lake, and cross roads should be made at convenient distances; if such roads* were made, and the Jungle cut down, many persons with small incomes would be glad to build in these parts, more particularly about Entally and Tiljullah, from being so contiguous to Town, where many of such persons have offices to attend daily. Ballygunge is rather too far off for such people, and would appear to approximate to such places as Allipore, and Garden Reach, for gentlemen who can afford to have gardens and large compounds and out-houses. In all probability such new buildings in Entally and Tiljullah would be built upon an improved plan. If small houses, or indeed any houses, were built upon godowns, with apertures to keep such godowns well aired,† which might be used for servants, or to keep things in, would it not be better than the out-houses we now see, with the high compound walls surrounding every place, and which prevents the ingress and egress of air, and renders the air the inmates breathe more confined and foul? And if *Iron rails*‡ were more generally adopted in the place of the heavy compound walls with pompous gates, habitations would be much more airy. *Large Tanks* upon an improved plan are much required all about Entally and Tiljullah, *as well as along the Circular Road generally*, and I have known in very dry seasons this want not only extremely distressing to the poor Natives, but to poor Christians also on *both sides* of the Circular Road, who have often complained to me how much they feel the want of this essential necessary of life. Such large Tanks would not only produce mould to fill up little cavities, dirty pools, and certain unnecessary ditches, but they would, if placed where four roads meet, tend greatly to make the place more airy. I think Bishop Heber describes Mirzapore, where there was a school and some Missionaries, as dreadfully unhealthy;§ the clearing since adopted has rendered that place very healthy; the Bishop also, I think, was told by his Sirkar how notoriously bad the Entally Nullah was, and that he never passed it without his handkerchief to his mouth.

The Natives where they reside make all their Tanks small, and as if it was intended that Malaria should be produced, they seldom fail to *plant trees round* their Tanks, so that you commonly see the surface of them quite green from the vegetation—this must have been remarked by every one; such are abundant about Entally, on the right and left side of the Balleegunge lines, and all down the Russapaglah road and Tolly's Nullah, and not less so in *Kidderpore*. I am of opinion that trees ought never to be planted upon the borders or banks of Tanks or Nullahs, for their leaves invariably find their way into the water, and lying upon the edge decompose, and go much more to produce the Malaria we complain of, than they can act as a safeguard or barrier to arrest the Malaria, as *supposed by some authors*, although I do not deny that large belts of trees at a sufficient (I mean, a considerable) distance from a City, and *properly* placed, may *perhaps* have such good effect, but such an opinion ought not to induce the plant-

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* Sir Edward Hyde East strongly advised broad roads in the direction of the winds, and surface Draining instead of so many deep Drains as we have, which become stagnant. He thought the more superficial surface Draining properly managed, would keep the upper surface of the earth tolerably clear and dry. That part of Chowringhee behind the Theatre, and between that place and the Burying-ground, is acknowledged now to be much more healthy than it was before the new roads, Tanks, and buildings were made.

† Such a plan of building ought to be generally adopted in all low situations in Bengal.

‡ Since writing this, several houses have been thus improved; among them, three of the largest houses in Esplanade Row now are allowed to receive air, a clear breeze from the Maidân which was formerly shut out by high walls.—*August*, 1837.

§ Now an excellent Square, a good large tank with iron rails round the grounds, and Mrs. Wilson's School is in the corner of the Square. A large building is now erecting there by the General Assembly of the Scotch Church, for the education of Native youth, and the place is now acknowledged to be healthy.—*August* 1837.

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ing-trees near a City, where they are certain to be injurious, not only by their leaves rotting, but by impeding the winds, and preventing the rays of the sun approaching the ground, which remains damp, and assists in the unwholesome decomposition. Such is the case in all the Jungle villages around Calcutta, and is evidently the cause of the great yearly mortality in them. All the gentlemen who have gone with me in my drives, agree in the positive statement, that, throughout India, they never met with such crowded green pools, Jungle, and bad smells, as abound around Calcutta every where in the Suburbs; and it should here be remarked as regards filthy pools, and Tanks, that they may not only be the cause of sickness by contaminating the air, but may affect the Natives who constantly bathe in them, as well as *drink* the *filthy* water of such Tanks; for in all probability, Malaria *may* become impregnated with water, and may thus be taken into the system by the skin or stomach.

For farther improvements, and removing impurities of air at this Presidency, the Draining of the Lake and cutting down the Jungle beyond it, I conceive to be of great importance. The Jungle all down to the Sea should be removed, if possible, and it would be a great advantage, if Excavations,* or Docks, were made here and there, on each side of the New Communication for ships and vessels to lie in, so as not to obstruct the passage of vessels to and fro. The face of the Lake may probably be materially altered. Ritchie, who surveyed the Soondurbuns in 1791, speaks of the well-known village of Tarda, which is marked on all the maps (as being on the borders of the Lake). This place is now about the same distance from the further borders of the Lake, as the distance is from the Balliaghat entrance, along the navigable Canal to its present furthest *borders*, on the South, *Bamanghatta*; therefore if Ritchie was correct, a very large portion (nearly half) of the Lake must have filled up naturally, for on each side of the river from Bamanghatta to Tarda, is thick low Soondurbun Jungle. *I imagine that upon the finishing the Canal now making, and its opening into the Hooghly, that the Lake will almost Drain itself*—as the low water of the river Hooghly is at times *lower* than the Lake at low water. Whether this Lake be Drained, or not, or either so partially Drained as to be fit only for rice cultivations, or otherwise warped by mud from the river, so as to be converted into garden ground, nevertheless, it is highly desirable for the general health, that not only the grounds on this side of it be cleared and improved, but that the Soondurbuns beyond it be removed as far from the capital as possible.

No. VII. *f.*

A. 5.

Letter to Sudder Nizamut Adawlut on the state of Grounds near the Insane Hospital, and generally throughout the Suburbs, pointing out the general Unhealthiness produced by their Jungly and Filthy state, with additional remarks made at a later period on the effects of the Inundations.—1828.

It will be seen that the number of Deaths in the Insane Hospital in these six months has been only 10, a number considerably less than has been usual during the same period for the last 12 years. It appears to me that this advantage has been produced by the making of four sunken and covered necessaries, the nuisance having previously been conveyed by an open Drain from the Hospital, and round the grounds.

* There has been a large Dock excavated near the Salt Works on this side of the Lake.—*8th June*, 1841.

† Such is the case now when the River is at its lowest, and the Flood Gates are allowed to be open.—*8th June*, 1841.

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I have the pleasure also to report, that there has since been much less illness than usual, which I consider mainly attributable to the improvement and change above alluded to. I beg leave, however, to remark, that the grounds contiguous to, and outside of the Hospital premises, are in my opinion, a most unwholesome nuisance, particularly during the rainy season, the water not being Drained off, but lying in the various hollows, there stagnates; and corrupting all vegetable and animal matter it meets with, produces an atmosphere most unwholesome even to Natives, who are used to it.

There is also close to the entrance gate a Burying-ground, which brings together dogs, vultures, &c. which of themselves are a considerable nuisance, and upon which grounds the prisoners from the Jail of the 24-Pergunnahs are daily taken in a body for their necessary occasions. Were they to be taken nearer to the Nullah to which this ground adjoins, or elsewhere for such purposes, and the practice of burying discontinued at that place, it would be not only desirable, but would conduce to the healthiness of the Hospital.

While remarking on the state of the grounds near the Hospital, it may not be irrelevant for me to observe, that having for upwards of twenty years applied my attention particularly to atmospheric* causes of disease, and having now for several years been Surgeon of the Suburbs of Calcutta, I may not be going far, if at all, out of my line of duty, in pointing out, that I consider much of the unhealthiness of the Suburbs, as well as of Calcutta during and after the rains, to arise in a great measure from the state of the lands in the Suburbs immediately round about the Town, but more particularly in the Soorrah, Entally, and Balleegunge part of the Suburbs. The lands bordering upon these parts, especially to the Eastward, are not only more covered with Jungle and decaying vegetable matter than elsewhere, but in almost every part of them numerous irregular excavations are to be met with, made for brick-making, and for similar purposes. In these various holes and cavities impure air is generated by the decay and putrefaction of vegetable matter in water, and if impure air so produced is, as it is known to be, capable of causing fever and dysentery, it is not unfair to conclude that certain modifications of this Malaria may also be the cause of cholera, which disease predominates in those climates and soils in which fever and dysentery abound. That it may be so produced, is I think sufficiently obvious by the well-ascertained fact, that ship's crews in a state of perfect health and a considerable distance, even some miles from the shore, have, by a sudden land wind coming on, been fatally attacked by the scourge. A striking instance of this nature is recorded by Dr. Macculloch in his very valuable work lately published on the subject of Malaria, a work entitled to the particular attention of medical men and others in this country, which is so pregnant with this source of disease. I will here add, that I can name at this moment several families about Entally, where the whole family are laid up with fever, produced most indisputably by the impure air generated about their neighbourhood, by the decomposition or decaying of vegetable substances, and several are now removing up to Chinsurah and to other places, their removal being more conducive to their recovery than any medicine they can take, while they continue to breathe this atmospheric poison.

(Signed) F. P. STRONG,
Surgeon to Suburbs of Calcutta.

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* I was emboldened in these remarks to the Suddur Nizamut Adawlut made in 1828, from the circumstance of my having been from 1805 to 1815, Surgeon to the Kent Dispensary; during these Ten years I was in frequent communication with the late Dr. Macculloch, who has written so much upon Malaria, and the above appointment, together with my private practice, gave me an extensive opportunity of judging of the correctness of that gentleman's opinions; and I knew well, some of the localities he alludes to in his work, and know his remarks to be quite correct.

These circumstances brought my attention to the subject of Malaria at an early period.—*August* 1837.

(Sd.) F. P. S.

No. VII.
F. Pemble Strong, Esq. Surgeon to 24-Purgunnahs, 8th June 1841.

No. VII. *g*.

A. 6.

Copy of the 9th Paragraph of F. P. Strong, Esq. Letter to the Medical Board, dated January 27th, 1834.

There are in more distant parts of the Suburbs, guards or depôts of prisoners, who are not so comfortably provided for as those in the Jails, and I have sometimes had occasion to remark upon their unhealthiness, particularly the one at Garden Reach*, which was situated in the midst of Drains, and from which five cases of cholera came into the Hospital in four days. The Nazir's guard, situated in Kidderpore, was so unhealthy in the last quarter of 1832, that fourteen cases of most malignant cholera came into the Hospital from that guard in less than a week, as was noticed in my Returns.

(Signed) F. P. STRONG.

No. VII. *h*.

A. 7.

Copy from the 9th Paragraph of a Letter from F. P. Strong, Esq. to the Medical Board, dated March 21st, 1835.

The same patients (alluding to the patients of the Native Insane Hospital) after being discharged apparently cured, coming into the Hospital again and again from obviously unhealthy localities, and other considerations connected with unhealthy situations which would embrace too much space to enter upon at large in this Report, tend to confirm me in my opinion, that in the climate of this part of Bengal, atmospheric Malaria, aided by the sudden variations in the temperature of the air, and consequent sudden check to perspiration,—by bad food, poverty, miserable clothing, and housing in huts crowded together in swampy filthy situations, with a want of cleanliness and ventilation,—by the habits of long fasting, and the use of impure water, (this being the usual mode of existence among the lower orders of Natives,) is highly calculated to produce diseases, which often ultimately end in insanity.

This general cause of disease which so much predominates in the Suburbs of Calcutta, I forcibly brought to the notice of the Sudder Nizamut Court in the year 1828. About this time I was requested to wait upon the Governor General, and I afterwards wrote several papers upon the subject to his Lordship, in which I entered into an explanation of what I conceived to be the principal causes of Unhealthiness in Calcutta, its neighbourhood, and the lower part of Bengal. In doing this, I was naturally led to make some remarks upon those great sources of Malaria,—the Salt Water Lake and the Jungly Soondurbuns

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* A new Guard House for the prisoners has since been erected on a spot fixed upon by myself, and the executive Officers.—F. P. S. *8th June* 1841.

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adjoining, considering that the Draining of the one, and the Clearing of the other, would be a great Public benefit, if even done only with a view of removing such causes of Malaria, and consequent illness.

In some of the unhealthy spots, but particularly that broad belt of dense Jungle and ill-Drained ground, which exists from the Dum-Dum road, and is continued through Sealdah, Entally, Balleegunge, Bhowanipore, and down the Russapuglah roads, reside a vast number of people of all denominations connected with the City of Calcutta, and who are constantly suffering from illness, which I conceive might be, in a great degree, obviated by removing such evils by a proper system of large clean Tanks*, with no trees upon their banks; raising the ground; Regulations against Nuisances; and good Draining. Were this, or some similar plan adopted, we should get air more fresh and free, and a healthiness would, I think, be obtained, that does not now exist.

In one of the papers I have alluded to, as having formerly written, I particularly mentioned that the year 1828 was a more healthy year than any I had known; I did not then anticipate that the following years would have been so calamitous.†

The last five years, the period for which the Medical Board require to be furnished with the details before alluded to, have been unhealthy to a degree unheard of or unknown before, owing no doubt to the Inundations which have extensively existed to an unprecedented degree; particularly in the four last years, an Inundation having occurred in each year, sweeping away a great part of the population between parts of the 24-Purgunnahs to the Southward of Calcutta and the Sea, and spreading over other lands to an enormous extent; destroying the cattle, and the produce of the earth, which has not yet recovered from its effects. Most of the wretched Inhabitants, of these before populous districts, who were not drowned, fled towards our City, and several of these unfortunate beings became inmates of the Insane Hospital. One instance in particular, I would wish to be allowed to refer to, as it is a strong case in illustration of the deep distress that must have been felt; and as exemplifying one of the causes of insanity.

The establishment at Gurriah-haut for affording them relief having been some time broken up, these poor unfortunate and starving wanderers were sent to my Hospital at Allipore, where I had frequently 60 or 80 of them at a time in Hospital. One poor woman was quite frantic; she would not be comforted or silenced, and becoming obviously Insane, she was transferred to the Insane Hospital last December. There she would take no nourishment, she said the floods had robbed her of her children, and she died in a few days, of extreme exhaustion.‡

Three of these Inundations, in the lower parts of Bengal, to which I have referred, were from the Sea,§ and the other, the last, was produced by the overflowing of the Damoda river.

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* At page 224 of Appendix D. to the Municipal Committee's Report will be found printed a Letter addressed by me to the Committee, on the subject of forming Tanks.—*8th June* 1841.

(Sd.) F. P. S.

† The paper was written in July, 1829. For a short period, about the middle of the year 1828, there was a good deal of Fever in the Entally Suburbs, but the following twelve months were healthy. *August*, 1837.

‡ September 21st, 1833. I was asked by the Magistrate, Mr. Barlow, to suggest any means for arrangements,—so many prisoners and paupers being sick, he did not know how to lodge them,—to which, on the 22nd, I replied, that "if the paupers increased greatly, the old Bhowanipore guard, into which we put the Nazir's people, with evident advantage, might be available upon this occasion," and I recommended the removal of convalescent ulcers to the Jail, to make room for paupers in the Hospital, while the guard was getting ready.—*August*, 1837.

§ These Sea Inundations produced extraordinary mortality, so also did the Damoda Inundation; but not by any means equal to those of the Sea. The discovery of a large proportion of sulphuretted hydrogen in the waters of the Estuaries and Coast of Africa, by Professor Daniell, is likely to lead to some useful results in the investigation of

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These particular floodings, I mean the Sea and the Damoda river, are unfrequent when compared with the overflowings of the Ganges, which are more frequent, and seldom attended with equally serious consequences. It will be seen, by a reference to the Transactions of

the nature and causes of Miasmata arising from Inundation of the Sea. The presence of sulphuretted hydrogen in water is easily detected by the brown colour of the precipitates afforded by nitrate of silver, and by acetate of lead; but for purposes of investigation, the gas should be collected, and its quantity in a given portion of water, accurately ascertained in all situations in which Miasmata on the Sea coasts prevail. It is worthy of remark, that some facts recently brought to light, give reason to believe, that the mortality on the Coast of Africa may be caused, or is certainly much *increased* by the exhalations of the Sea water, which in some instances, contains more than eleven cubic inches of sulphuretted hydrogen in a gallon. Now when it is considered that so small an admixture as one-fifteen-hundredth part of this deleterious gas in the atmosphere acts as a direct poison upon all animals, it is difficult to believe that it does not aggravate, if not *directly originate* disease on those coasts where it abounds.

Professor Daniell feels convinced, that the evolution of sulphuretted hydrogen is intimately connected with the unhealthiness of such stations, and he alludes to the sufferings described by the traveller, Macgregor Laird, whose illness occurred in the very locality from which some of the waters, which the Professor examined, were taken; and he mentions that the test of a little solution of the sulphate of copper will detect its existence, and adds, that the contact of chlorine with sulphuretted hydrogen, instantly effects its decomposition, and renders it perfectly innoxious. He refers to the 19th vol. of the Annales de Chemie, p. 225, to shew that the worst cases of Malaria are connected with the decomposition of the sulphates in Sea water; and has shewn in the most satisfactory manner, that by excluding the Sea from certain extensive Marshes, there were no appearances in the following year of the terrible maladies which had appeared every year previously from the mixture of Fresh and Salt Water, which in summer was rarely changed, and becoming corrupt, spread infection over the neighbourhood, of the most destructive kind. Professor Daniell, in a letter to Capt. Washington, R. N. gives the following results of some experiments on the action of Sea water upon decomposed vegetable matter; and also a simple mode for fumigation by Chlorine, to obviate the bad effects of this poison.

To CAPTAIN WASHINGTON, R. N.

My dear Sir,

As any confirmation of my idea, that the unhealthiness of the African coast is dependent, in a great degree, upon the evolution of sulphuretted hydrogen, is calculated to give confidence to those who are about to start upon the Expedition to the Niger, from the certainty of the means of counteraction within our power, I hasten to communicate to you the result of an experiment which certainly determines the origin of that deleterious gas to be the re-action of vegetable matters upon the sulphate of soda in Sea water.

On the 2nd of November last, I placed a quantity of newly-fallen leaves in three glass jars capable of holding about $1\frac{1}{2}$ gallon of water.

No. 1. Upon the first I poured about a gallon of New River water.

No. 2. Upon the second I poured about the same quantity of the same water, in which 3 ounces of common salt had been dissolved.

No. 3. Upon the third, the same quantity of water in which three ounces of crystallized sulphate of soda had been dissolved.

The three jars were then placed in a warm chamber, the temperature of which varied from about 70° to 110,° and the water was filled up from time to time, as it evaporated, and the mixture well stirred.

Upon examining them yesterday, the following was found to be the state of the jars:—

No. 1. Had a very disagreeable odour, but produced no change whatever upon paper soaked in acetate of lead.

No. 2. Was perfectly sweet, and possessed, indeed, a rather agreeable odour. It produced no effect, of course, upon the test paper.

No. 3. Had a most insupportable sickening odour, much worse than that of pure sulphuretted hydrogen, and instantly blackened paper soaked in acetate of lead, throwing down sulphuret of lead with a metallic lustre.

If you, or any of your friends, would like to see the experiment in its present stage, it would give me the greatest pleasure to shew it.

Now, for all this, chlorine fumigation is the certain remedy, and I have taken the liberty of sending you herewith some Memoranda for conducting the process, with the earnest hope that they may be useful to the Expedition.

I remain, &c.
J. F. DANIELL.

King's College,
5th February, 1841.

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the Physical Class of the Asiatic Society, page 260, part 1,—" That an Inundation of the Sea, or of the Damoda river, is supposed not to happen oftener than once in a Century." That remark is in allusion to the dreadful Inundation in 1823; and I can find no other account of any Sea Inundation, except the eventful one of nearly a Century ago, which happened in the night, between the 11th and 12th October, 1737, to be found in the Gentleman's Magazine 1738-9: besides great damage to shipping and boats, 3,00,000 souls are said to have perished.

I know of no written record as to the effect of this Sea Inundation upon the health of the Inhabitants, although it was an event sufficiently remarkable to be handed down from father to son; and I have met with old Natives who have heard of it from their fathers. But of the late Inundations which I allude to, their effects are so generally known, that it is unnecessary for me to dwell upon them, although I may be allowed to add, from inquiries I have made, that these effects have not been confined to the poor alone, but that landholders of respectability, and their families, have been carried off by disease, and this over a vast extent of populous country, and particularly so in parts bordering on our South and South-east Suburbs of Calcutta; and great numbers of these Zemindars who fled to Bhowanipore, and to this City for change of air and Medical attendance, died of the diseases produced in their Villages. In corroboration of what I have stated as to the general unhealthiness produced by the Inundations, and the consequent impure atmosphere, I beg leave to mention a few particular examples which I have learnt. One Native gentleman of wealth assures me, that his property has been greatly increased by the numerous deaths in his family; and another old gentleman has often enumerated to me the dreadful mortality, which has deprived him of all those relations of his, who lived beyond Gurriah-haut, about Barriepore. Another Native who is Interpreter to the Mysore Princes, named Nilcomul Bonnerjee, who resides at Bhowanipore, writes me that his wife a few days after the Inundation of 1833, went to her father's at Barro, a village three coss South of Barriepore, in a pregnant state, and found two, three, and four persons die every day at each house; that they wanted hands to bury the dead; that in two or three days her mother, brother, aunt, uncle, and nine near relations died; she was confined, and there was no one to look after her. The writer on hearing this, sent three women and four servants, they all returned ill to his

Memoranda for Fumigation by Chlorine.

One part by weight of common salt, and one part of the black oxide of manganese are to be acted upon by two parts of oil of vitriol, previously mixed with one part, by weight, of water (9 measures of acid, 10 of water,) and left till cold. Such a mixture will immediately begin to evolve chlorine at a temperature of 60°, and continue to do so for four days in a gradual manner, without the application of any extraneous heat.

The vessels in which the mixture is made may be flat pans of any common earthenware.

3½ lbs. of the mixed salt and manganese, with 4½ lbs. of the mixed acid and water, are calculated to yield 5½ cubic feet of chlorine.

In suspected situations it would be desirable to have one or two charges of 3½ lbs. of the salt and manganese placed on the windward side of the deck, to be renewed on every fifth day.

It is, however, impossible to give directions for the exact quantity, the object being to preserve an atmosphere smelling of chlorine, but not sufficient to produce any irritation of the lungs, or coughing.

Between the decks this kind of fumigation would be too strong; but pans containing chloride of lime and water would be sufficient protection:—the solution, however, should be frequently renewed.

A charge of the chlorine mixture would be very advantageously placed in the hold, if it were to be found not to produce any serious annoyance. It should also be remembered, that there is nothing injurious in the odour of chlorine, provided it be not in such excess as to produce coughing.

J. F. DANIELL.

King's College,
5*th February* 1841.

Calcutta,
8*th June* 1841.

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residence, and with exception of his wife and child, they all died in a week. Ever since his wife has been ill with fever and spleen until lately cured. He states, that at this time the number of children daily sold by destitute parents in the 24-Purgunnahs is enormous.

I have a letter before me, signed by the old gentleman ; he writes—" In confirmation of the truth of Nilcomul Bonnerjee's letter, I can say that I had thirty relations residing in the neighbouring villages in 1832-3: only one boy is now living, but ill with spleen, out of all these relations. A great number of respectable families suffered, as Cossinauth Mullick, Bhagwan Chowdry, and others of opulence and respectability. The first and twenty others, (being the whole of his family,) all died except one girl ; and the last and about eleven in family, all are dead but one boy, who ran away to his uncles. This misfortune was almost universal."

It would not be difficult to add many similar examples, all equally proving the wide-spread devastation and death caused by the flood and the impure atmosphere ; and I have given the above information in the same detailed manner as I have heard it, to shew the vast extent of general mortality. Many must have been lost in obscurity ; for when we see families possessing the necessaries and comforts of life suffering to so great an extent, it may readily be conceived, how great must have been the sufferings of the poor, abject, and starving.

(Signed) F. P. STRONG.

NOTE.—Both these places, referred to in the above extracts, are now much improved.—*29th August*, 1837.

(Sd.) F. P. S.

No. VII. *i.*

A. 8.

Letter from F. P. Strong, Esq. dated 4th October 1830, to Major Benson, returning the late Dr. Buchanan's Papers, and sending, for the information of the Governor General, some Papers written by Capt. Jenkins.

To MAJOR BENSON,
Military Secy. to the Governor General.

MY DEAR SIR,

Pray accept my best thanks for the Papers on the means of promoting the Health, Comfort, and Convenience of the Inhabitants of this City, which I now return with many apologies for keeping them so long. Not trusting my own judgment regarding the nuisances of the Town, I sought the opinion of Captain Jenkins, who has written some Papers on several of the Nuisances, and proposed to remedy some, and with his permission I enclose them for the perusal of the Right Honorable the Governor General. I will only in this place, venture to express a hope, that when the new Eastern Canal is finished, that the levels of Calcutta will be efficiently taken, and something in the way of Draining the Town done.

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* Referring to Dr. Buchanan's papers returned by Dr. Strong, to Major Benson.—J. M.

Regarding the Suburbs, the paper marked No. 21,* exhibits a deranged state of things, similar to what now actually exists. Many of the recommendations there suggested to Drain and Level the Grounds about Kidderpore, where the stagnant water is represented as being injurious to persons residing in that neighbourhood, and on the grounds both on the right and left of the Allipore road, just beyond the bridge, now particularly apply. It is also there stated, that the grounds behind the General Hospital had been represented as having been injurious to the Invalids in Hospital; a road is proposed to be made from this part towards Bhowanipore, or the Russapaglah road; and one crossing this from near the Hospital, Southward to Kalighaut; and it is remarked that these roads would be of material consequence to the Natives. A Cut also from Tolly's Nullah behind the General Hospital is suggested. If such Cut or Canal were made to join the New Eastern Canal, now nearly finished, in the North-eastern division of the Suburbs, it would of course be extremely desirable for the Drainage of Chowringhee, and all that part of the City; the bad state of Drainage, Jungle and Swamps throughout the Suburbs, and particularly down the Russapaglah road, I have already brought to the notice of the Governor General, and must not now intrude further upon his Lordship's valuable time, but subscribe myself, with many thanks to you.

Yours, &c.

4th October, 1830. *(Signed)* F. P. STRONG.

No. VII. *j.*

A. 9.

Letter from Major Taylor, calling on F. P. Strong, Esq. to attend a Committee at the Government House on Draining Calcutta, the Lake, &c.

To Dr. STRONG.

My dear Sir,

The Governor General has desired me to request you to meet the gentlemen named in the margin† at the Government House on Tuesday next, at half-past two o'clock P. M. for the purpose of considering the Drainage of Calcutta in connection with the present Circular Canal, and the project of extending it round the Salt Water Lake into the deep water channel at Bhamunghatta, together with the Drainage and Silting up of the Salt Water Lake.

Govt. House,
27th December, 1834.

Yours, &c.
T. W. TAYLOR.

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† D. McFarlan, Esq.
R. D. Mangles, Esq.
Capt. Steel,
Dwarkanath Tagore,
Col. Galloway,
—Hoseason, Esq.
J. Kyd, Esq.
Capt. Fitzgerald,
Ramcomal Sein,
Col. Tickell, C. B.
J. R. Colvin, Esq.
J. Prinsep, Esq.
Capt. J. Thomson,
Capt. Forbes,

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No. VII. *k.*

A. 10.

Letter from F. P. Strong, Esq, to Mr. Mangles, transmitting some Papers.

To R. D. MANGLES, ESQ.
Secretary to Government of Bengal.

Sir,

It affords me considerable pleasure to observe, that the Medical Topography of this City, and its Suburbs, is exciting attention; and as it is likely that this subject in connection with the Fever Hospital may be brought before the Government, I feel it in some degree incumbent on me, from the situation I hold, to forward to you, to be laid before Government, whenever the subject may be brought to their attention, some papers, shewing that so long ago as the year 1828, I had addressed the Sudder Nizamut Adawlut, as well as the Right Honourable Lord William Bentinck, and on a later occasion, the Medical Board, upon the same subject; and it will give me great satisfaction to find, that some *active* measures of Improvement result from the present discussion.

Calcutta, I am, &c.
June, 1835. *(Signed)* F. P. STRONG.

No. VII. *l.*

A. 11.

Letter from Mr. Mangles, acknowledging the receipt of the above Papers.

To Dr. F. P. STRONG,
Assistant Surgeon of the 24-Purgunnahs.

Sir,

I am directed by the Honourable the Governor of Bengal, to acknowledge the receipt of the interesting Papers to which your letter of the 18th instant gave cover, and to assure you, that your opinions will not be overlooked when the matters to which they relate come under the consideration of Government.

I am, &c.
Fort William, *(Signed)* ROSS D. MANGLES,
The 23rd June, 1835. *Secretary to the Government of Bengal.*

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No. VII. *m.*

A. 12.

Census of the Population in the Suburbs of Calcutta.

Names of Thannahs.	No. of Villages.	No. of Mehals.	Resident Hindu Adults.	Hindu Children.	No. of Hindus in Service.	Resident Mussulman Adults.	Mussulman Children.	No. of Mussulmans in Service.	Native Lodgers or Passengers.	European Adults.	European Children.	East Indian Adults.	East Indian Children.	Total Inhabitants.
Thannah Sulkeah, ...	132	258	33,223	20,342	*8,106	12,154	4,395	*2,019	3,153	43	24	63	49	73,446
Ditto Chitpore, ...	8	33	14,177	5,286	984	1,627	601	199	875	23	7	53	1	22,650
Ditto Manicktulah, ...	31	42	20,627	6,173	30,100	13,201	9,661	3,098	3,883	441	67	759	123	54,935
Ditto Tauzeeraut, ...	29	84	22,032	5,349	1,120	8,601	2,755	647	5,072	54	15	45	27	43,950
Ditto Nowhazaree, ...	1	28	8,465	2,689	799	5,845	2,214	987	2,818	63	3	50	65	22,212
													Grand Total,	2,17,193

* The columns are not included in that of the Total.

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No. VII. *n.*

A. 13.

Abstract Statement of Deaths among the Native Inhabitants of the City of Calcutta during the following years, shewing the number per Month, the Grand Total, and the average rate per cent. as per last Census.

Years.	January.	February.	March.	April.	May.	June.	July.	August.	September	October.	November.	December.	Grand Total.	Average per cent. per last Census.	
1831	No. Returns.		179	456	342	325	384	463	589	682	1,067	753	5,240	2·90	
1832	880	571	691	637	754	511	616	759	885	951	988	1,065	9,308	4·28	
1833	1,167	1,170	1,519	1,710	1,209	683	898	1,088	1,657	1,788	2,449	2,185	17,523	8·07	
1834	1,068	732	891	1,326	1,296	589	958	1,224	983	1,198	1,564	1,238	13,067	6·02	
1835	867	624	683	662	673	492	633	568	676	771	870	593	8,112	3·78	
1836	637	535	680	692	628	600	628	733	638	770	713	641	7,895	3·63	
1837	652	562	631	661	725	1,034	733	763	661	645	669	728	8,464	3·89	
1838	674	721	1,651	2,389	1,434	549	487	632	663	628	767	798	11,393	5·24	
1839	606	599	577	604	465	484	588	594	502	756	851	1,349	7,975	3·67	
1840	1,326	1,356	1,349	1,095	854	555	746	807	834	706	1,101	1,001	11,730	5·40	
	7,877	6,870	8,851	10,232	8,380	5,822	6,671	7,631	8,088	8,895	11,039	10,351	1,00,707	4 64	PerAnnum.

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No. VII. *o.*

A. 14.

Mortality among all Classes in Calcutta for 20 *years, but for the Native Population only* 8 *years.*

Years.	Protestant	Burials.	Catholic Burials, D. Rozario.	Catholic Burials, Boitockanah.	Greeks.	Armenians.	Indo-Armenians.	Native Christians.	Natives.	
1817	216	Scotch burying-ground began 1826.	313	169	4	10	3			
1818	272		211	159	2	20	3			
1819	275		284	158	0	23	3			
1820	281		282	136	0	17	1			
1821	246		277	172	0	16	3			
1822	324		294	140	0	16	2			
1823	270		277	156	0	10	2			
1824	278		282	188	0	21	1			
1825	297		285	154	1	12	10			
1826	275		309	145	2	19	17			
1827	254	11	308	174	0	15	16	4	Native Deaths for 8 years.	
1828	256	19	250	170	2	15	12	3	Hindu, ... 8,299	9,308 in 1832.
1829	184	21	209	146	3	12	16	2	Mussulman,.. 1,009	
1830	224	26	236	138	1	14	15	0	Hindu, .. 15,138	17,523 in 1833.
1831	186	29	236	122	3	17	19	8	Mussulman, .. 2,385	
1832	217	25	269	121	1	17	16	1	Hindu, .. 11,167	13,067 in 1834.
1833	302	30	288	204	2	23	14	5	Mussulman,.. 1,900	
1834	281	35	257	199	2	16	17	4	Hindu, ... 6,873	8,102 in 1835.
1835	233	18	233	115	1	7	16	4	Mussulman. .. 1,229	
1836	197	26	188	104	0	15	13	3	Hindu, ... 6,366	7,881 in 1836.
									Mussulman,... 1,515	
	5065	240	5288	3070	24	315	199	34	Hindu,... .. 7,097	8,464 in 1837.
									Mussulman, .. 1,367	
	20	10	20	20	12	20	20	9	Hindu,.. .. 9,802	11,316 in 1838.
									Mussulman, ... 1,514	
Avg.	253	24	264	153	2	15¾	10	3⅓	Hindu,.. ... 6,570	7,975 in 1839.
									Mussulman, .. 1,405	

No. VII.
F. Pemble Strong,
Esq. Surgeon to
24-Purgunnahs, 8th
June, 1841.

No. VII. *p.*

A. 15.

Statement of the Mortality per cent. among the different Classes of Inhabitants in Calcutta per Census and Tables of Mortality for 5, 8, 10, 20, *and* 23 *years.*

Denominations.	Population per Census.	Mortality per Tables of Mortality and Registers of Burials.												Average Mortality of the several classes and periods ascertained.						General Mortality of Calcutta as far as ascertained.	
		For 5 years, ending 1836.		For 10 years ending 1836.		For 20 years ending 1836.		For 1837.		For 1838.		For 1839.		For 8 years.		For 13 years.		For 23 years.			
		Died Annually.	Per Cent. per Annum.	Died Annually.	Per Cent per Annum	Died Annually.	Per Cent. per Annum.	Died.	Per Cent.	Died.	Per Cent.	Died.	Per Cent.	Died. Annually.	Per Cent. per Annum.	Died Annually.	Per Cent. per Annum.	Died Annually.	Per Cent. per Annum.	Died Annually.	Per Cent. per Annum.
Christians, Scotch Burials,	7884	..	..	24	..	..	..	34	..	40	..	45	..	..	..	35¾	..	..	3·55.		
		..	..	..	..	..	3·51	..	3·34	..	5·43	..	3·94	..	..	..	..	..			
Protestant, ...		..	..	..	..	253	..	230	..	231	..	265	..	..	..	..	..	244¾			
Catholics, Principal Church,	3341	..	..	..	..	264	..	251	..	266	..	233	..	..	...	..	..	253½	10·97.		
		..	..	..	..	..	12·48	..	10.56	..	11·64	..	9·18	..	..	..	..	..			
Ditto, Boitockanah Church,		..	..	..	..	153	..	102	..	123	..	74	..	..	..	.	..	113			
Armenian, ...	636	..	..	..	..	15	..	23	..	15	..	20	..	..	..	..	..	18¼	4·48		
		..	..	..	...	..	3·93	..	4·87	..	4·56	..	4·56	..	..	..	..	..			
Indo-Armenian, ...		..	..	..	..	10	..	8	..	14	..	9	..	..	..	..	..	10¼			
Total Christians, ...	11,861	..	..	24	..	695	6·06	648	5·46	689	5,81	646	5.44	..	..	35¾	..	639¾	569		
Mahomedans, ...	59,622	1607	2·69	..	..	..	..	1367	2·29	1514	2.53	1405	2·35	1473	2·47	...	..	..	..		
Hindoos, ...	1,57,418	9569	6·7	..	..	..	..	7097	4·50	9802	6·22	6570	4·17	8260	5.24	.	..	...	..		
Total of all Classes, ..	2,28,901	11,176	+	24	+	695	5·20	9112	3·98	12005	5.24	8621	3·76	9733	×	35¾	×	639¾	..	10,408½	4·54

No. VII.
F. Pemble Strong, Esq. Surgeon to 24-Purgunnahs, 8th June, 1841.

No. VII. *p.—Continued.*

A. 15.—*Continued.*

Proportions.

Census.

	Catholics,	Protestants,	Mahomedans,	Hindoos.
Mahomedans, 1 to				$3\frac{2}{3}$
Protestants, 1 to			$7\frac{1}{2}$	20
Catholics, 1 to		$2\frac{1}{3}$	18	$47\frac{1}{8}$
Armenians, 1 to	$5\frac{1}{4}$	$12\frac{1}{3}$	$93\frac{3}{4}$	$247\frac{1}{2}$

Annual Mortality.

	Protestants,	Armenians,	Hindoos,	Catholics,
Hindoos, 1 to				$1\frac{5}{6}$
Armenians, 1 to			$1\frac{1}{3}$	$1\frac{5}{11}$
Protestants, 1 to		$1\frac{2}{9}$	$1\frac{6}{9}$	$3\frac{1}{12}$
Mahomedan, 1 to	$1\frac{5}{12}$	$1\frac{5}{6}$	$2\frac{3}{8}$	$4\frac{5}{12}$

No. VII.
F. Pemble Strong,
Esq. Surgeon to
24-Purgunnahs, 8th
June, 1841.

No. VII. *q*.

A. 16.

Abstract Statement of Deaths among the Prisoners of the Allipore and Russapaglah Jails, aud different Guards in the 24-Purgunnahs, during the following years, shewing Number per Month, the Grand Total, and the Average rate per cent.—1711$\frac{7}{20}$ being the average Number of Prisoners throughout the period; more than two-thirds of those are Prisoners for life, the rest temporary, like all other Zillah Prisoners; shewing the three months of greater Mortality to be the cold weather months, as in Calcutta.

Years.	January.		February.		March.		April.		May.		June.		July.		August.		September.		October.		November.		December.		Grand Total of Prisoners.	Grand Total of Deaths.	Average Number of Prisoners.	Deaths per cent.
	No. of Prisoners.	No. of Deaths.	No. of Prisoners.	No. of Deaths.	No. of Prisoners.	No. of Deaths.	No. of Prisoners.	No. of Deaths.	No. of Prisoners.	No. of Deaths.	No. of Prisoners.	No. of Deaths.	No. of Prisoners.	No. of Deaths.	No. of Prisoners.	No. of Deaths.	No. of Prisoners.	No. of Deaths.	No. of Prisoners.	No. of Deaths.	No. of Prisoners.	No. of Deaths.	No. of Prisoners.	No. of Deaths.				
1820	1,833	30	1,903	13	1,996	20	1,921	16	1,940	16	1,831	9	1,807	16	1,821	9	1,700	11	1,705	13	1,681	10	1,750	16	21,888	179	1,824	9·81
1821	1,816	17	1,809	10	1,832	11	1,927	12	1,974	11	1,995	7	1,894	10	1,778	16	1,772	20	1,762	9	1,759	24	1,762	20	22,080	170	1,840	9·24
1822	1,795	18	1,805	7	1,879	13	1,799	11	1,848	4	1,851	3	1.889	9	1,681	11	1,612	11	1,597	20	1,571	9	1,544	14	20,871	130	1,739	7·47
1823	1,629	11	1,644	10	1,595	10	1,593	7	1,635	6	1,571	10	1,511	10	1,416	12	1,386	10	1,404	14	1,394	9	1,385	9	18,163	118	1,514	7·79
1824	1,481	6	1,529	11	1,426	9	1,375	6	1,403	8	1,328	11	1,228	7	1,293	7	1,290	11	1,295	3	1,491	4	1,559	4	16,698	87	1,391	6·25
1825	1,599	6	1,498	10	1,434	17	1,463	18	1,249	17	1,187	8	1,139	9	1,151	13	1,051	15	1,173	8	1,122	12	1,088	7	15,154	140	1,263	11·08
1826	1,117	7	1,137	4	1,138	2	1,161	3	1,129	14	1,142	6	1,148	6	1,138	7	1,157	3	1,177	6	1,113	3	1,140	6	13,697	67	1,141	5·87
1827	1,179	6	1,212	4	1,116	7	1,153	7	1,226	15	1,232	1	1,298	2	1,304	5	1,210	7	1,271	8	1,242	6	1,198	5	14,641	73	1,220	5·98
1828	1,227	11	1,153	7	1,260	23	1,299	11	1,338	7	1,304	5	1,287	8	1,298	3	1,327	3	1,287	6	1,365	6	1,309	10	15,454	100	1,288	7·76
1829	1,327	15	1,289	4	1,376	6	1,330	12	1,395	6	1,386	5	1,434	8	1,466	5	1,386	6	1,459	3	1,487	4	1,886	12	17,221	86	1,435	5·99
1830	1,486	3	1,552	6	1,457	8	1,497	4	1,536	6	1,536	10	1,564	6	1,573	10	1,566	8	1,553	23	1,521	29	1,889	21	18,730	134	1,561	8·58
1831	1,474	19	1,575	10	1,586	11	1,651	9	1,632	16	1,619	11	1,635	7	1,615	11	1,545	12	1,531	29	1,945	29	2,081	23	19,893	187	1,658	11·27
1832	2,219	23	2,013	7	1,924	22	1,909	11	1,944	10	1,984	6	2,227	4	2,047	11	1,706	12	1,964	19	2,153	24	1,909	27	23,999	176	2,000	8·80
1833	2,067	12	2,118	13	2,372	28	2,170	11	1,918	7	2,117	7	1,982	10	1,991	21	2,037	23	2,217	37	2,087	33	2,209	29	25,285	231	2,107	10·96
1834	2,322	18	2,807	9	2,317	13	2,154	14	2,147	9	2,111	10	1,988	14	1,872	16	1,879	17	1,896	28	1,785	19	1,913	22	25,191	189	2,099	9·01
1835	2,109	23	2,188	7	2,211	11	2,037	13	2,035	14	2,225	9	2,118	6	2,013	8	2,002	9	1,843	7	1,836	7	1,883	10	24,500	124	2,042	6·07
1836	1,806	8	1,776	5	1,720	3	1,894	9	1,829	6	1,796	7	2,103	7	2,024	11	1,869	8	1,873	12	1,706	13	1,876	11	22,272	100	1,856	5·38
1837	2,021	10	1,928	3	1,953	9	1,947	4	1,982	8	1,984	15	1,912	8	1,916	8	1,939	6	1,938	8	1,961	12	2,048	10	23,529	101	1,961	5·15
1838	2,025	8	2,046	7	2,159	8	2,143	11	2,121	12	2,203	10	2,237	9	2,191	9	2,221	12	2,160	11	2,155	13	2,165	19	25,826	129	2,152	5·99
1839	2,215	10	2,242	12	2,130	8	2,089	13	2,109	8	2,087	16	2,125	5	2,170	6	2,217	5	2,179	11	2.175	16	2,062	19	25,800	129	2,150	6·0
	34,747	261	35,224	159	31,881	239	31,512	202	31,390	200	34,489	166	34,526	161	33,758	202	32,872	209	33,284	275	33,553	282	34,656	294	4,10,892	2,650	34,241	7·75
Percent p annum	1,737	904	1,761	539	1,744	820	1,726	701	1,719	700	1,724	574	1,726	562	1,687	717	1,643	761	1,664	991	1,677	1007	1,732	1016			1,712	

No. VIII.

No. VIII.
Samuel Smith, Esq.
22nd June, 1841.

To J. GRANT, ESQ.
Member of the F. H. and M. I. Committee.

Sir,

I was duly favored by the receipt of your Letter of the 17th February last, but as I was, at the time, on the point of leaving Calcutta for a season, and therefore unable to give due personal attention to the subject before my departure, I took the liberty to forward the Queries, respecting Intally, to the Members of the Intally Conservancy Committee, of which I am Chairman, with a request, that all or any of these gentlemen would assist me in replying to your Questions. Two Members* have complied with my request, and as they possess much local knowledge, and have resided for several years in Intally, which I have not, I take the liberty to enclose their replies, as well as my own, and hope they may afford your Committee some information, though not all that has been required.

I have the honor to be,
Sir,
Your most obedient servant,
SAMUEL SMITH.

Dorjeeling,
22nd June, 1841.

No. VIII. *a.*

Answers by S. Smith, Esq. to the same Queries to which Answers were requested from W. C. Blaquiere, Esq. by the Committee, upon the Fever Hospital and Municipal Improvements, 16th February, 1841.—Vide pages 21 to 24.

A. 1. I have never resided at Intally for more than three or four months at a time, during the hot season; but I have had a house in that Suburb for about seven years, and have visited it frequently.

A. 2. My house is close to the Canal, and about two miles from Government House, Calcutta.

A. 3. My house is in a principal Street, called the North Road.

A. 4. There are *now* but a few trees near my house—formerly there were many: as there are still all over Intally—a perfect Jungle in many parts of it.

A. 5. I consider Intally healthier than the densely populated parts of Calcutta, especially in the hot weather and the rains: it would be so most decidedly at all seasons, in my opinion, were Intally cleared from Jungle, and properly Drained.

A. 6. I always feel in better health and spirits when at my Garden house, (Intally,) than I do at my Town house, although that is in Tank Square.

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* Messrs. T. Wilson, and M. Crow.—J. M.

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Samuel Smith, Esq.
22nd June, 1841.

A. 7. Yes—because Intally is covered with Jungle and filthy stagnant pools and tanks; but I have often observed, in my morning rides, that the Maidan in front of Government House has been enveloped in fog, when there has been none in Intally.

A. 8. From 1st March until 31st August.

A. 9. Fevers, Agues, Dysentery, and Spleen, amongst the Natives, caused principally, as I believe, by the low damp huts they dwell in, and the use of bad water.

A. 10. There have been Epidemics, but I cannot speak precisely as to their nature. The Cholera principally, arising as I suppose from the causes stated in para. 9, and from exposure of the person to the damp night air, and to sudden chilling changes of the atmosphere, unprotected by proper clothing.

A. 11. The accumulation of filth and silt was very offensive at one time, and is so still, at the head of the Canal, near the Circular Road. People have forsaken their houses on this account. But the evil is of late much abated, by greater attention to cleansing it, and by the opening into it of the River through the Circular Canal.

A. 12. I have no opportunities of personal observation on the subject; but I have always considered the vicinity of the Salt Water Lake as very unhealthy—and have seen many sufferers from visiting it even for a day. The Natives who dwell near the Lake, are subject to frequent attacks of Fever, Ague, and Spleen, as I am informed.

A. 13. Water is supplied from private Tanks and Pools. Some of the Tanks contain very good water; others indifferent; but the majority very bad. There are no public Tanks, and towards the close of very hot seasons, when the preceding rains have not been so abundant as usual, the distress of the poorer Natives is very great. The subject has been brought to the notice of Government, in the very strongest terms, by the Intally Conservancy Committee, but without effect.

A. 14. With the exception of a few, and only a few, private Tanks, all the Tanks in Intally are covered more or less with green scum, or luxuriant vegetation.

A. 15. I believe it does not undergo any filtering or other preparation, beyond passing it, occasionally, through a dirty cloth.

A. 16. I have not.

A. 17. Most of the Tanks and Pools and the Ditches and Drains of Intally are overhung by trees, the leaves of which fall therein, decompose, and engender Malaria; which is distributed by the winds all over Intally, and even into Calcutta. The Drains, Ditches, and Tanks of Intally are fruitful nurseries of Malaria. The Conservancy Committee, do all that their means enable them to mitigate this evil, and have applied to Government for the means of doing more.

A. 18. I can give no information on this subject, worthy of confidence; but I believe the Magistrate of the 24-Pergunnahs can, or the Surgeon of the Suburbs, Dr. Strong, who possesses much information on these, and other local subjects.

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Samuel Smith, Esq.
22nd June, 1841.

A. 19. About one-third of the Native Inhabitants are Mussulmans, I am informed.

A. 20. There are several Mahommedan Burying grounds in the district; but they also bury their dead occasionally in their own Gardens, and near their Musjeeds.

A. 21. The Mahomedan Burying grounds are not well taken care of, and are at times very offensive. They are considered a sad nuisance to the neighbourhoods in which they are situated.

A. 22. There are Christian burial grounds on the Circular Road, North Road, Sealdah, and Tiljullah, all for Roman Catholics, I believe, unless perhaps the last.

A. 23. The Conservancy of Intally has for the last four years been under the charge of a Committee, appointed by Government, who have done much good; but the means of the Committee are small; the extent of the district is considerable, embracing from the Dum-Dum Road on the North, to Ballygunge (*not* inclusive) on the South; the Salt Water Lake on the East; and the Circular Road on the West. The Roads, with few exceptions, are cutcha; the Drains all cutcha, without system or levels, and there are but about 60 convicts and 20 carts to repair all these roads, and clean all the Drains and Ditches. The principal Roads and Drains are kept in pretty good order, the others are, more or less, neglected for want of labourers. The subject is now before Government.

A. 24. I think the Draining of the Lake would have the most beneficial effect on the climate of Intally, and of Calcutta also. Perhaps, while under process of Draining or Warping, much sickness might prevail about and near the Lake, but eventually, the benefit would be very great.

A. 25. My own personal experience does not enable me to reply; but from communication with several old Inhabitants, I learn that within 20 years, there have been three stages of healthiness, and the reverse.

1. Good—when Mr. Elliott was Magistrate, and 500 convicts were employed in making roads and keeping them in repair, and cleaning the Drains, and cutting down Jungle, (5 years).
2. Bad—when in after years, Intally was neglected, and the convicts reduced to 60 or 70, and the Magistrates left the Roads and Drains to the care of the Overseer, almost entirely, (10 years).
3. Good again—or approaching to it, when the Roads, &c. came under the Civil Engineer, and eventually under the Honorary Committee, who have now charge of them, (5 years).

The Intally Canal *was* a serious nuisance; *now* it is not so, except at the head of it near the Circular Road, as already stated; but this evil is daily decreasing, since the Canal has been under Captain Boileau's charge, and also a communication has been opened through the Circular Canal with the River, and into the Salt Water Lake.

SAMUEL SMITH.

22nd June, 1841.

No. VIII. *b.*
Mr. T. Wilson.

No. VIII. *b.*

Answers by Mr. *T.* Wilson, *to the same Queries to which Answers were requested by the Committee upon the Fever Hospital and Municipal Improvements from W. C.* Blaquiere, Esq.—*Vide pages.* 21 *to* 24.

Answer 1. I have lived many years in the Suburb of Entally, forty-two in the house, South Road Entally, and three in the present, which is situated in Baneepooker.

A. 2. About a mile from the Canal, and two from the Government House.

A. 3. My house is in a lane. It has a Garden attached to it.

A. 4. Yes, many; and generally speaking, there are too many trees and underwood in the Suburbs. "The Bagheechas," as they are called, are no better than Jungles. In many parts the branches of the Trees completely shade the Roads, and prevent the rays of the sun from penetrating and drying them; and in the rains, the drippings from the leaves keep the Roads in a wet state.

A. 5. Although the climate is the same, yet, I consider Calcutta healthier. I except those spots where there are dense Native populations.

A. 6. To its efficient Conservancy, to the improvements which are daily being made to every part, which add to the means of comfort, and consequently to the health of the Inhabitants.

A. 7. Yes, much more so than Calcutta,—and these fogs are caused by the numerous filthy Tanks and Ponds. For some time my attention has been directed to the state of these Ponds. In my division, though the smallest, yet, not the less populous, every piece or parcel of ground has one or two of these Ponds or Pits, which hold stagnant water during many months in the year. There must be upwards of a thousand of these Ponds in my division.

I have endeavoured to persuade the Inhabitants to fill them up; to convert the spaces now occupied by these stagnant Ponds into gardens; to plant vegetables for sale.

As the greatest part of them are Tradesmen, who earn their living in the City, who leave their homes at 9 A. M. and return at 5 P. M. These could easily command an hour or two in the mornings, and an hour in the evenings, to attend to their gardens, and by such means would better their circumstances (whereas, now, they generally spend their evenings in the Toddy or Arrackshops.) But the reply is, we cannot plant vegetables. Give us the Earth, and we will fill up the Ponds. Why cannot you plant vegetables? Because Goats, Swine, Cows, and Tattoos will come and destroy them. But you can easily prevent them by fencing off the spots? We are too poor to do that. You can send the Cattle to the Pound or to the Thannahs? We cannot do that, the Pound and Thannahs are not convenient to go to. We do not remain at home, we go to work, our wives and Daughters cannot take the Cattle to the Thannahs: if they did, it would be at the risk

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Mr. T. Wilson.
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of being beat and abused by the owners of these Cattle. Who own these Cattle? Eight out of every Ten belong to the Chowkedars.

It is, I fear, with great truth that this charge is brought against the Pounding System. The present mode of Pounding Stray Cattle is exceptionable, on account of the trouble and disadvantage attending it to the sufferers, and is seldom resorted to. Were the parties who suffer their Cattle to run on their neighbour's property, besides being severely fined, made to pay to the sufferers the full amount of the property destroyed by their Cattle, and the Peons attached to the Conservancy Establishment, who are constantly employed in their respective Divisions, also directed not to suffer any Cattle to stroll about the Streets and Lanes; it would, I think, be a means of preventing the loss of much productive domestic labour to the community.

To furnish available means to the industrious and well disposed classes, is a matter of great consequence. Destitute as these people are, of the means of improving their condition, and labouring under many prejudices, the lessening of their troubles is an object worth attending to. Thus many are kept poor and idle; and Idleness is the parent of want, and of many diseases.

Considering of what consequence it is to the health of the Inhabitants, that these stagnant Ponds should be filled up, and the advantage the poorer classes would obtain for bettering their condition, if the difficulties attending the present Pounding System were removed, I have taken the liberty to mention what I consider as out of place; but I trust the Municipal Committee will not take it amiss, but use their influence in suggesting such means as will remedy the evil.

A. 8. From April, to the end of July—that is, after the strong winds have blown away the infectious matters—though it is then warmer, yet the Season is more healthy.

A. 9. Fevers prevail to a great extent. The Dysentery, Spleen, Influenza, &c. &c.

A. 10. The Cholera rages with dreadful malignity from January to April, when a considerable number of the poorer classes of the Inhabitants fall a sacrifice to this malady, and many die for want of timely assistance.

Without losing sight of the finger of God, to whose decree alone this visitation must be traced, several circumstances may be mentioned, which, humanly speaking, greatly aggravate this evil. The changes in the weather, from heat to cold; exposure to the Night Air; the eating Fish caught in the Stagnant Tanks and Ponds; the using a greater quantity of Acid Fruits, such as Tamarinds, Plumbs, Green Mangoes, &c. &c.; the drinking copious draughts of brackish water direct from the Tanks, when warm and perspiring; all which tend to injure the digestive organs.

Also cases of severe Bilious attacks occur, occasioned from exposure to the Night Air, at their Weddings and Feasts, which generally take place in this season of the year, and on which occasions the Natives are not very abstemious.

A. 11. The Canal formerly was considered a great nuisance, as it then emitted a very offensive smell: but in its improved state it is far from being so. The inconvenience at present felt, from the stench arising from the filth and silt which collects near the late Mrs. Howard's premises, could be avoided if greater attention was paid to the part where it now collects; and if encouragement was given to the Dealers in Chunam, to settle near the part, in the room of the Wood-sellers, who at present occupy the Banks.

A. 12. The Salt Water Lake has long been noted as occasioning sickness: but not hav-

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ing made personal observations, I cannot tell how the spots near it are affected by the flux and reflux of the tide. From inquiries on the subject, I have learned from others, that all the spots near it are injurious to health; that intermittent and remittent fevers prevail in its neighbourhood.

A. 13. Many Tanks in Entally contain good water; but the distress experienced from the want of Public Tanks, particularly in the hot season, is inconceivable. The extent of the distress may be judged from the following facts:

In the hot season, when the Tanks get very low, the owners of these Tanks, who had hitherto allowed their Native neighbours water from their Tanks, are compelled to stop the supply, from fear of losing their fishes, and of being deprived of it for their own domestic purposes; water being an indispensable article of life to a Native, and their drink being only water, words are inadequate to express their grief on the occasion. At first they flock in numbers to the gates of the places where they were in the habit of getting water; use intreaties and cries for admittance; but cries and intreaties avail not; they are driven away. They then go into the interior, and fetch water from Tanks which are surrounded by trees—water on which the beams of the Sun never play, and which of course must be very unwholesome—and by drinking this brackish water, subject themselves to many diseases.

It is generally known that, when a person has been in the habit of using water from one particular tank, if he drinks it from a different tank, he suffers for it; hence the reason of the care that many take, of having their water always from the same Tank.

Another circumstance which demands consideration is, that this duty of procuring water for domestic purposes generally falls to the lot of the females of a Native family—many of whom are great sufferers, by being obliged to leave their infants behind.

Permit me, therefore, to submit to the Committee, the propriety of their recommending a more considerate attention to this domestic comfort. The whole pecuniary expense for this benefit will be but a trifle, compared to the pleasure and satisfaction the Government will feel, in being able to contribute to the preservation of the health of multitudes. It will draw forth the gratitude of the Native Population, and convince them, that, while their Rulers, are generously seeking to improve their mental comforts, their domestic comforts are not disregarded by them.

Ground for excavating Tanks could be purchased cheap, the price of land being very low at present; but central spots should be fixed upon for the purpose, that the Inhabitants, living in the interior, may also enjoy the benefit. Should the Government be prevailed upon to remove this grievance, so generally felt, by giving the Inhabitants four or five Tanks, I trust it will be such as becomes them.—Large Tanks, with large open Squares, to which suitable names might be given, such as Auckland Square, Eden Square, Ryan Square, Grant Square, &c.

Another very great advantage would be obtained—a large quantity of earth would be available for the purpose of filling up the Stagnant Ponds, &c., which the Inhabitants would gladly do themselves, as the spaces now occupied by these Stagnant Ponds would be recovered for many purposes, and many of the Cutchah Roads could be raised.

A. 14. None free from green scum and vegetation.

A. 15. Few keep it overnight in Culsees; but the greatest part drink it direct from the Tanks.

A. 16. The Lightning is frequent and severe; whether the Cocoanut, Bamboo, and Plantain trees attract it, I cannot tell. In many instances I have seen it fall on these trees. In June 1839, Nine Cocoanut trees were destroyed by one flash, the sight was fearfully sublime!

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A. 17. To many circumstances; such as the great quantity of leaves—which, falling into the Drains, decay and putrify. The falling of the leaves into the Drains is occasioned by their being, in numberless places, overhung with trees, which not only branch over the Drains, but the Roads also.

To noxious exhalations, arising from the Tanks and Stagnant Ponds, which, in the dry season, present a bare surface, covered with rank weeds undergoing putrid fermentation.

I have noticed that, after a very hot day, if there should be a North-Wester in the evening, and with it some rain, the water in the Stagnant Ponds during the Night, gets heated to such a degree, as to destroy the fishes in them. Next morning they are seen floating on their backs near the sides of the Ponds—when these stinking fishes are taken up, and used as food by the Natives.

To Woods and Trees, which in many places are so very thick, as to appear like Jungles; the consequence of which is, that the beams of the sun being thereby hindered from penetrating to, and warming the soil, the soil becomes damp; the air confined; and the vapour arising from the ground so corrupt, as to affect the whole atmosphere.

This evil, I am sorry to say, is increasing. The Natives consider this a good way to mark and increase the quantity of their lands; and is, I fear, the cause of many litigations: were only an eighth of the trees left standing, and the rest cut down by the owners themselves, abundance of fruit and profit would result; and a most beneficial change would take place in the Physical condition and aspect of the place.

To the number of public and private Musselmen Burying Places.

To the putrid exhalations from the filth and impurities from the European and Native Tanneries, which run into the Drains, and accumulate,—and which the Convicts will not clean out—which matter assuming unremoved, a putrescent action, is extremely prejudicial to the health of the Inhabitants.

To the water in the Drains becoming stagnant, for want of a free course.

To the effluvia arising from human ordure. In the Suburbs, the Maturs never convey the filth to the River; nor do such of the Natives who have necessaries, ever keep them clean: but as their necessaries have a communication with the drains, the filth runs into them.—But the major part have no necessaries.

A. 18. The population is numerous; what the exact number is, I cannot tell, not having time and means to take an estimate. The yearly ravages of the Cholera is decreasing the population very much. The Births fall far short of the deaths. Those living in the interior have families, but mostly those living near the City, live in a state of Adultery.

A. 19 There are many Musselmen families at Entally; but the Hindoos form the great body of the population; there are, on an average, two Musselmen to three Hindoos.

A. 20. At Gobrah, Ballygunge, Suldee Mullah, Ballygunge, Curbullah, Teeljullah, Tallpooker, Subgache, Manic-Tullah, Causee-Baughan, Tangrah, Googoodungah, besides a great number of private burying places.

A. 21. Yes. In the Mahomedan burial places, where many of the bodies being scarcely covered by the earth, are constantly dug up by the Jackalls—and the very surface of such spots become a mass of corruption, and contaminate the Air.

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A. 22. In Seealdah, Teeljullah, &c. &c.

A. 23. The want of proper Drains, I mean such Drains as will give the water a free course downwards, and not only carry off the water from Entally, but the water from the South-Eastern parts of the Town; and the want of a sufficient number of hands to clean out the Drains is severely felt. Formerly upwards of five hundred Convicts were employed on the Roads and Drains; now about sixty and seventy. The Drains should be cleaned out at least twice every week; whereas they are cleaned only once in the year; some once in two years: and all the Drains near the Tanneries, never. The consequence is, that rank weeds grow in them; stagnant water and filth, &c. remain in them, and emit a very offensive smell.

The present Roads are extremely narrow, winding, and wretchedly laid out, and are become much worse, from encroachments that have been made on them. Out of the many, seven only are Puckah, and that, not throughout; the rest are all Cutchah: many are little better than ditches, causing, in the rains, great inconvenience to foot passengers, who force their way through these miry Lanes; and many are obliged to make a great turn, to go a short distance.

It has long appeared very surprising, that the conveniencies, and local situation of Entally, have not been properly considered. While the Town has been improving with that ardour characteristic of the British nation, this place, situated as it is so near the heart of the "City of Palaces," and only a few minutes' drive to all the Public Offices, Marts, &c., should have remained, with few exceptions, stationary so long. The reason why it does not proceed in improvements is, that the Landlords, or Owners of Houses, experience very great difficulty in recovering their rents. The law as regards Landlord and Tenant is different here; the same facility for recovering rent does not exist as in the Town. Here a Tenant may occupy a House for months, and not pay a pice of the rent; leave it when he chooses, and laugh at his Landlord. Many Landlords have shut up their houses, verifying the proverb, "Better an empty house than a bad tenant." Others have pulled down their houses, sold the materials, and let the Land out to Ryuts, at low rents.

As long as this disadvantage to the Landlord continues, I fear the attempt to Tax the Suburbs will be a fruitless job. The trifle that will be collected will not pay the expenses for collecting it. It will also affect the price of Land, already deteriorated in value, and check all improvements; as, no doubt, many who intended building residences for their private use, on their Lands, would perhaps give up the idea of doing so.

A. 24. It would make the Suburbs more healthy. Many Thousand Beegahs of land would be gained for Agricultural purposes, and many lives and property saved from destruction by land spouts. I remember instances of three; the one in April 1838 was severe, when upwards of one hundred lives, and much property were destroyed.

A. 25. As far as my experience, and the testimony of many who have lived several years here, prove a material change to have taken place; the change, at first imperceptible, has gradually increased. The improvements in the City have operated to increase the unwholesomeness of the Suburbs. The Native population of the City has, in a great measure, been obliged to retire, and add to the numbers that were already in the Suburbs, and all the impurities attendant upon such a population, destitute of all cleanly habits, have been added. The connection there is, between malignant diseases, and dirtiness, is very well known. Open fields have been converted into Jungles, whereby a free circulation of air has been retarded. High spots of Land have been changed into Marshy and Stagnant Ponds, occasioned by the Brick merchants.

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Besides all these circumstances, there are others I could mention; but let these suffice. After what has been stated, can any person attribute the Insalubrity of Entally to its climate merely? Certainly not—Then there must be a cause. If there be one, remove it, and the effects will cease: and pray do not let the mere circumstance of a Ditch running between, act any longer as a cause why the Inhabitants of the Suburbs of Entally should be deprived of their health, and domestic comforts.

15*th April,* 1841. THOS. WILSON.

No. VIII. *c.*

Answers by Mr. M. Crow, *to the same ~~Answers~~ Queries to which Answers were requested by the Committee upon the Fever Hospital and Municipal Improvements from* W. C. Blaquiere, Esq. *Vide pages* 21 *to* 24.

No. VIII. *c.*
Mr. M. Crow,
18th May, 1841.

A. 1. I have been a resident of Soorah in the Suburbs of Calcutta for 9 years, and a Member of the Intally Conservancy Committee for 4 years; the Division under my charge extends from the Intally or Balliaghattah Canal to the Dum-Dum road, and my experience is limited to this locality, within which I have made observation on several of the points embraced by the Queries.

A. 2. My present residence is 400 feet to the North of the Balliaghattah Canal, and nearly 3,000 feet from the junction of the Circular Canal.

A. 3. My house is situated near a Metalled road, and in the midst of a Garden.

A. 4. There are a good many trees around my house.—With the exception of the extensive Paddy fields along the Salt Water Lake which is a perfectly open tract, this part of the Suburbs is thickly studded with trees of all descriptions.

A. 5. I consider the above locality to be healthier than the thickly Inhabited parts of Calcutta.

A. 6. I ground the above opinion upon personal experience and observation. My family, consisting of five Children from the age of fourteen to the age of one year, as well as of individuals in the prime of life and in advanced age, has enjoyed, generally speaking, much better health since my residence in the above place than it did when residing within the Town. My observation has shewn that at times when the Cholera Morbus is raging, the disease is neither so extensive nor so violent in its effects here as within the City, and this I attribute to the debilitating effects of heat being in this locality comparatively less.

A. 7. There is certainly a great difference between the climate of Calcutta and of this place. In hot weather this is less oppressive than the Town, owing, I believe, to the number of Pucka-houses in the Town, which must produce much heat by reflecting the rays of the sun. In cold weather also it is colder, with a greater degree of fog. On the whole, in my opinion the advantages are on the side of this locality.

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A. 8. From the month of March, to the month of September, I consider to be healthier than the remaining months.

A. 9. From the month of October, to the month of February, Ague and Fever prevail in this locality, and when this disease is not soon subdued by bark or any other febrifuge, it often terminates in spleen, which among the poorer classes and their Children especially, is very common. Acute fevers generally terminating in a fatal collapse, called by the Natives " Beegar," also occur. Some of these cases I have seen cured, when apparently there was no hope of life, by the administration of " Bisburrey," a Native preparation from Arsenic and other poisonous substances.

A. 10. I recollect in November, and December, 1839, this place was visited by an epidemical fever preceded by ague, and the patients generally recovered in 4 or 5 days. In a few cases however the heat of the body suddenly subsided, the pulse sunk, and with some exception, in which a reaction was brought on by the stimulating powers of the " Bisburrey," the sufferer died, Bark or Quinine producing no effect. But I have had no opportunity of observing the effects of professional treatment in these cases.

A. 11. I have never heard that the accumulation of Silt in the bottom of the Balliaghatta Canal, which is now a running stream, has produced any effect upon the health of the Inhabitants in its vicinity.

A. 12. Since the commencement of the Survey, which, under the orders of Government, I am now carrying on along the borders of the Salt Water Lake, I have had opportunities of observing the appearance of this locality and of its Inhabitants. Many of these people appear to have suffered, at some period of their lives, by the spleen, and many complained of fever and ague, caused, as they expressed it, by the Saltness of the Lake; but amongst these people I also observed several well made athletic Individuals, and some who had attained to the age of 60 and 80. These latter I generally questioned, and found that they had passed their lives in the neighbourhood of the Marsh. For a considerable distance, between the deep parts of the Lake and the high inhabited grounds, the country is alternately under water and dry, causing in most places a very unsightly slime, and emitting disagreeable effluvia. Further on towards the East, the Lake is deep enough to cover the ground even in the dry months. The flux and reflux of water in these Marshes is caused, throughout the year by the tidal influence of the Sea through the channels of the Sunderbuns and the Circular Canal, and in the rains by the overflowing of the streams and Drains, which pour their contents over these low lands.

A. 13. Tanks are the only source whence this part of the Country is supplied with water; many of these contain fresh and wholesome water; but some are putrid, and must be unwholesome. Towards the Salt Water Lake the Tanks are brackish, and the Inhabitants are obliged in consequence to resort for their supplies to distant parts.

A. 14. Perhaps one-half the number of Tanks are not free from green scum and floating vegetation; but these do not always corrupt the water. I have drank from Tanks completely covered with " Pana" very fine water; whilst in other instances I have met with putrid Tanks without any " green" vegetation on them.

A. 15. No process of filtration, except it be of a simple cloth which is sometimes used, is ever employed by the poorer classes.

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A. 16. Compared with Calcutta and Bengal generally, I have observed no peculiarity regarding electricity and other atmospheric phenomena in these parts. In April, 1837, I hear of a most violent current of wind having passed over a belt of the Marsh and its neighbourhood, which carried before it every thing it met, and caused great destruction of life and property.

A. 17. In the months of October, November, and December, the common effects of vegetable fermentation, viz. heat, smoke, and disagreeable odour from accumulations of vegetable substances exposed alternately to moisture and to the sun, are often met with; but my experience has not enabled me to trace the prevalence of any disease to these causes.

A. 18. I have at present no means whatever of forming even an approximate idea of the amount of the population in these parts; but as my Survey (which will extend to the whole of the Suburbs from Tolly's Nallah to Barnogore) progresses, I take down notes in a Tabular form of the number, &c. of the Inhabitants, and on other statistical points of information; and will perhaps be able, at the end of my present labours, to give correct information on these points.

A. 19. Mussulmans are found in every part of the Suburbs; but their number, &c. I cannot state until the completion of my Survey. The proportion of Mussulmans to Hindoos may be as 5 to 10.

A. 20. Casiah Bagan, and Kurbullah in Manicktollah, are the principal Burial places of the Mahomedans; but they also bury the dead on their own grounds, and near their Musjeeds.

A. 21. I am not aware of any facts connected with public Cemeteries as a source of disease.

A. 22. They have three Burial Grounds, one at Boitakhannah on the Circular road, one near the Balliaghattah Suspension Bridge, and a third on the North road Intally; to these all the poor Christian dead (Roman Catholics) both of Calcutta and the Suburbs are carried. The Chinese have a burial ground on the Chingreyhutta road, and the Parsees one on the Balliaghattah road.

A. 23. Nothing can be in a more deplorable state than the Drainage throughout my Conservancy Division; most of these channels for the exit of rain water are completely blocked up for want of hands to remove from them the vegetation of years, and the accumulation of mud. In consequence of this, almost the whole country is under water during the rains, and it is not until the rains have ceased for some months that these localities become dry. If the diseases prevailing during the cold season are to be attributed to Malaria arising from decaying vegetation, this must be considered as the chief cause of it. The Intally Conservancy Committee have scarcely ever so many as one Hundred convicts at their disposal for the Conservative care of all the Cutcha and Pucka Roads and all the Drains, &c. throughout their District, which extends from Kuroiah near Balligunge to the Dum-Dum Road. For such an extensive district, 500 convicts or coolees would not be too much, and until some radical improvement is made in this respect, the Conservancy of these Suburbs must continue in a wretched state.

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Mr. M. Crow,
18th May, 1841.

A. 24. The Draining of the Salt Water Lake, would in my opinion greatly improve the climate of Intally, not only by removing the unwholesome effluvia arising from extensive tracts which are alternately exposed to the action of the Salt Water and the Sun, but also by converting Salt Marshes into wholesome culturable fields and garden grounds. The opening of the Circular Canal into this Lake has caused a great alteration for the better; the fresh water entering this channel from the River has not only considerably reduced the salineness of the Intally Canal, and those parts of the Lake which border upon it, but has also assisted in filling up parts of the Lake itself by the sediment which it has deposited in all the places to which its current has extended. The process of filling up is constantly in progress in this Lake by the decay of vegetation, and a variety of other causes which have for ages formed some of the strata of the Gangetic delta; but these natural causes must take a very long time to effect the filling up of this Lake; and it would certainly be a great boon to the country if the slow progress of these natural causes were to be assisted by some judicious artificial means, such for instance, as that proposed by Lord William Bentinck, of warping the Lake by the admission of water from the river when it is loaded with sediment during the rains.

A. 25. During my residence here I have always found the climate of Intally such as I have described it; but I hear from old Inhabitants that the climate in the vicinity of the Intally Canal has considerably improved since the opening of the Circular Canal. The cause in my opinion for this change is the agitation which the water in the Intally canal (formerly altogether stagnant) now receives by the flux and reflux of the current flowing through it from the River, by means of the Circular Canal.

18th May, 1841. M. CROW.

No. IX.

No. IX.
Major W. N. Forbes,
Engineers, 13th Aug.
1841.

To THE HONBLE. SIR J. P. GRANT,
Chairman of the Fever Hospital and Municipal Improvement Committee.

Sir,

In compliance with the request conveyed by your Letter of date the 22nd of April, and referred to in a Letter from J. Morris, Esq. (the Clerk to the Committee), of date the 1st of June, I have the honour to forward Answers to the series of Questions proposed in the printed paper which accompanied your communication.

2nd. I regret that the occupation of my time, by Official duties, not admitting of postponement, has put it out of my power to furnish these replies at an earlier period.

I have now the pleasure of returning the printed Lists of Queries, and the Papers transmitted to me noted in the margin.*

I have the honor to be,
Sir,
Your most obedient and humble servant,
W. N. FORBES.
Major Engineers.

Calcutta Mint,
August 13th, 1841.

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* Municipal Committee's Report with its Appendices D. and G.

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No. IX.
Major W. N. Forbes, Engineers, 10th Aug. 1841.

Answers by Major W. N. Forbes, (Engineers) to the Queries marked No. I. *and No.* II. *to which Answers were requested from Captain A. H. E. Boileau, by the Committee upon the Fever Hospital and Municipal Improvements.—Vide page* 1 *to* 12 *of this Appendix.*

A. 1. I believe the description given by Captain A. H. E. Boileau, of the Circular Canal, and of the Entally and *Baliaghatta* Canals, the *latter* communicating at its Eastern end with the Canal and Channel passing through the Salt Water Lake, to be correct.

A. 2. As the Canal *has been* formed through the Salt Water Lake, it certainly would not now be expedient to incur the expense of excavating another channel round the Lake through the *ground* to the Southward, in the direction proposed by Lord William *Bentinck.* I believe the Canal was formed through the Lake in place of the more circuitous direction indicated in the plan inserted opposite page 47 of Appendix (G,) principally with reference to considerations of economy; it having been ascertained that without affording superior facilities for the Drainage of the Town, or of the Lake, the *circuitous course,* (partly from its passing through *Salt Works and property that would have required to have been paid for,*) would have been far more expensive than that adopted.

It will be seen (in page 41, No. VI. B. 2.) of Appendix (G,) that Captain John Thomson, (of the Engineers,) then *Superintendent* of the *Canals,* (and a Member of the Committee, who on the 11th of January 1834, reported on the simplest means of Draining and Warping up the Salt Water Lakes,) *estimated* that, (exclusive of the cost of Damming up four Nullahs,) the total expense of embanking *the Canal across the Lakes,* so as to answer both for Drainage and for towing path purposes, would have been 20,000 Rupees. The *proposal* for carrying the Canal circuitously to the Southward of the Lakes, appears partly to have been based on the assumption that the direct line could only be provided with *such embankments* at an expense greater than that of excavating the comparatively *long* and deep Cut *round*—an assumption that the estimate now referred to, and the circumstance previously mentioned of the value of the property the long line would have intersected, as moreover the fact that the direct line was ultimately sanctioned *as the cheapest,* sufficiently disprove.

The practicability of constructing, at a moderate expense, such towing paths, or embankments, is, I observe, further established by the reply of Captain A. H. E. Boileau to the 3d. Question* of the series under review; in which he states, that the "towing "paths of the Salt Lake Channel scarcely deserve the name, and might be very much "improved if the Superintendent of Canals had leisure to turn his attention to them." A representation further strengthened by his remarking, that "the improvement, or rather "perfecting of the present rude towing path *along the Lake Channel by converting it* INTO "*a* CARRIAGE ROAD *for five miles between Baliaghatta* and *Bamunghatta,* might perhaps "cost 40,000 Rupees, or 8,000 Rupees per mile."

It may be noted, that this estimate for a *carriage road* parallel to the Canal across the Lake, being a work of greater magnitude than the mere low towing path embankment (of greater length) estimated for by Captain Thomson, appears quite as moderate.

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* NOTE.—Dated the 11*th* of *February* 1841.

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Assuredly the facility with which such works could be formed on the existing *line of Canal* was in some degree overlooked by Lord William Bentinck, when (as in the 9th paragraph of his Minute, page 3, Appendix (G,) he alludes to *its* passing "*through an* " *open Lake,* only to be kept open by the use of a dredging machine, and not having " the benefit of a lateral embankment, except it be made at a considerable expense."

It is however known, that Lord William Bentinck, looked at, or surveyed, at least once, the Salt Water Lake, an experiment which the statements furnished by some of the parties, afterwards consulted on the subject of its Drainage, afford neither internal nor other evidence of their having *hazarded.* Being now the only survivor of the Committee (consisting originally of Mr. J. Prinsep, Captain John Thomson, and Captain Forbes,) who in 1834, were directed to Report on the Lake Drainage, I deem it not unnecessary to state, that, as concerned the question referred to the Committee, Mr. J. Prinsep was fully in possession of the views entertained by his brother, the late Captain Thomas Prinsep, (of Engineers) the *former Superintendent* of the Canals; and that as Mr. J. Prinsep, (who had for some time officiated in *this situation,*) was likewise well acquainted with the localities; and further, that as Captain Thomson was *at the time* the Superintendent of Canals, and, as such, familiar with all details and affections of the Lake; and moreover, that as he was aware that, holding this appointment, he would, if the works proposed were sanctioned, be ordered to Superintend their execution; it will be seen that, at least as far as concerns these parties, the Committee was so constituted as to embrace the best practical information obtainable on the matters brought under discussion; neither, it may be observed, were the principles of operation, unanimously assented to, submitted by the Committee until all the Plans and Papers bearing on the subject had been studied, and the Canals and Lake carefully examined.

It was known that the portion of the Canal passing through the Lake stood in need of towing paths, which could most easily and cheaply be formed by embankments; economy which then (as ever since) required to be held in view, possibly, in part, led to the conclusion, that there could be no very serious objection to making the embankments, stood in need of for towing paths, (and the construction of which was desirable as the means of augmenting toll profits,) also answer for the purposes of Draining and Warping up the three Swamps, which, being at certain periods united, have here been alluded to, as one Lake.

The general principle of the plan proposed by the Committee in their Report of date the 11th of January 1834, (see page 38, Appendix G,) appears to have been principally objected to by Col. Sir Thomas Anbury, on account of its *brevity,* as in the course of his Minute he adverts to an old plan of his own, virtually based on the same principle, and which he additionally describes as nearly similar in some of its details. The description and explanation of *the details* of the Committee's Plan, as also the preparation of the Estimates, were in the first instance undertaken by Captain Thomson, who, as Lieutenant Colonel Craigie has noticed, would, from the appointment he held, have been likely to have been employed in the execution of the work proposed, and who certainly would have been willing to have held himself responsible for its success.

From Colonel Galloway's Minute, (page 44, Appendix G,) it appears, that the plan proposed by him recognised the correctness of the principle of operation recommended by the Committee, and in fact that his plan merely proposed effecting by portions, and by separate detailed embankments, and sluices, what the Committee had considered could be more economically effected by those running parallel to the Canal across the Lake, and at the same time serving as towing paths.

By the plan facing page 46, Appendix (G,) it will be seen that the embankment proposed by him from the letter A. (at Baliaghatta,) to the letter H, (at Jurrool,) would, if conducted from A. along the Northern bank of the Canal, have formed an embankment,

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and also a towing path, along the entire portion of the Canal called in the plan, the "*Lake Channel.*"

It will further be seen, that had the embankment been carried in this direction, and of merely the same length and dimension as from A. to H. it would have additionally included the central portion of the Lake, situated between the village of Jurrool and that of Hatgatcha.

Neither will it be overlooked, that it was with this view, and as enabling the largest portion of the Lake to be warped up at the least expense, that the Committee recommended that one of the embankments, (there also serving as a towing path,) should be conducted along the Northern side of the Lake Channel.

In this site, and on the Southern side of the Canal, *such towing paths* as had been raised, would have formed part of the embankments proposed by the Committee. Colonel Galloway appears to have remarked, that "the Scheme presented by the Committee is "chiefly confined, save the Feeder to the process of *Draining* the Lake, not of Warping," but it will be perceived that the 3rd Answer in the Committee's Report in reply to the Question, "the best mode of executing the work," states, that it would be "*by embanking out the Salt* "*Water, as above described,* and by providing sluices for the discharge, at ebb tide, of "rain water or of alluvion-charged* water admitted by the Canal, *and by a feeder,* join- "ing the Hoogly and the upper end of the Lake, *for the purposes of irrigation, of ameliora-* "*ting the soil,* and of *raising the Level of the Lakes by Warping.*" *From this* and from the circumstance of the Estimate accompanying the Committee's Report, having included (see page 44, Appendix G,) the sum of 70,000 rupees as the cost of cutting, and of forming bridges and sluices on the proposed feeder (or Canal); as further, from the fact of 800 beegahs of land required as the site of the feeder, having been estimated at 4,00,000 rupees, it will be seen that the Committee did not fail to direct particular attention to the most essential part of the subject of Warping.

As Lieut. Schalch, (page xxii, 2nd Appendix D. of volume Appendix G,)† states, that previous to the formation of the Circular Canal; "the only *direct* communication between "the River and Lake (was) by the Mahratta Ditch, from Chitpore to Saumbazar bridge, "and the Ditch on the side of the Dum-Dum road to the head of the Lake at the two "bridges near Saumnuggur;" and as‡ Mr. Blechynden, (2nd Appendix D. to volume G. page lxxv,) also writing previous to the cutting of the Circular Canal, further states, it is true that the River water enters at Chitpore Bridge, and passes through the Chitpore Nullah into the Mahratta Ditch, and thence through *various outlets* to the Lake, it will, with reference to these statements, and to the fact, that previous to the opening of the Circular Canal, the Town Drains aided by the alluvion-charged water thus obtained from the River, annually carried down to the Lake an immense mass of mud and sediment, be perceived, that the cutting of this *Canal* (forming a receptacle for these desposits, and serving to transmit both them, and the alluvion of the River water entering it either into the Lake Channel, or down to the deeper channels below it,) in reality greatly retarded a process previously in progress for filling up the Lake, in fact an operation closely allied to Warping.

On this point Captain Thomas Prinsep, (see Memorandum dated the 16th of February 1830, page 21, Appendix G,) remarked, "that the Lakes if left to themselves, "would in the course of time fill up of their own accord, and that such process is now in activity is confirmed by the rapid increase of vegetation within my own knowledge."

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* Note.—This should rather have been "water that had been charged with *alluvion,* but which had deposited it in the Lake."

† Appendix to Appendix G, page xxii.

‡ Ibid p. lxxv.—J. M.

(*Signed*) W. N. FORBES.

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And in confirmation of this fact, D. Stewart, Esq. M. D. (see Evidence, dated 28th of July 1836, page 151, Appendix D) observes, that "not more than forty years ago "the Salt Lake was much nearer to Calcutta than at present. At a village called "Ramkisonpore, a mile from the high road leading to Dum-Dum, is a mound or tumulus "of about thirty feet in height, surmounted by two venerable peepul trees, from either "of which, if ascended by help of a ladder, a magnificent view of the surrounding "country, and of the Lakes' whole expanse may be had. This mound which retains "its native name of Dum-Dumma, not forty years ago was on the edge of the Lake; "it is said to have been raised by the Burmese or Mug traders, who frequented the port, "and used to anchor their boats at this place. The Lake has now receded nearly a mile from "its foot, and the whole circumference has been gradually contracting in a similar way for "many years." Dr. Stewart also mentions, (page 153, Appendix D,) that "encouragement "having been held out by Government of long leases, within the last twenty years, much "land has been redeemed from the margin of the Lakes.

Regard being had to these circumstances, and to facts, either noticed in the Evidence, collected by the Municipal Committee, or by other means placed beyond doubt, it cannot but be inferred that the beneficial process of filling up the Salt Lakes was in a great measure put a stop to by the formation of the Circular Canal; this partly by its having diverted from them the great annual deposits carried down by the Town Drains situated to the Northward of the Durrumtollah Street, and partly from its having closed up the old Chitpore Nullah, which previously, by "various outlets," admitted from the Hoogly a body of water charged with alluvion.

It moreover is evident, that this injurious effect, in place of having been remedied, would have been augmented, if Lord William Bentinck's plan* of carrying "the new Circular Canal round the Lake, and as close to it as possible," had been adopted; inasmuch, as thus conducted, it would have additionally excluded from the large portion of the Lake lying to the Southward of the present "Lake Channel," all the deposits of the Town Drains proceeding from Chowringhee, and from the portion of the Town of Calcutta, situated to the Southward of the Durumtollah Street.

In paragraph 10th of His Lordship's Minute† above referred to, he states, that "In "consequence of the height of the Freshes in August and September exceeding the surface of the lower part of Calcutta by near 6 feet, and the adjacent plains between "7 and 8 feet, it was necessary to erect lock gates at the mouth of the Canal. This "precaution would not be requisite if the Canal was cut over the dry Land, and "the sides raised to a level if thought more secure, of the banks of the Hoogley "itself. I consider these locks to be objectionable, inasmuch as when shut, they produce a "suspension of the current, and a consequent deposit of silt.—It may be expected that "this process of silting up, so great in the Entally Canal, and in the adjoining part of "the Lake, may be much diminished, when by the New Canal the tides will ebb and "flow daily, and that during the rains there will be a more rapid current. This will no "doubt be the case in the overland cut, and I think it not impossible that the bottom of the "new cut, by the effect of the scouring of the water in its confined channel, may be "brought to the same depth as the Hoogley at one end and the Creek at the other, or "between 15 and 20 feet at low water." Now on this it may be observed, that had an *unlocked*, embanked, or "overland" cut of this description been made, the water freely entering it from the Hoogly, in the freshes alluded to, would most certainly have

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* See page 2, paragraph 5th of His Lordship's Minute, Appendix G.

† Dated the 2nd of February, 1830.

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so raised the Level of the Circular Canal or the upper portion of the Cut, where it was entered by the Town Drains, as not merely to have stopped their discharge, but further to have made them convey into the lower divisions of the Town, such a body of water as would, during the time of high water, have kept them completely inundated. Had it not been thus proposed by His Lordship to have left the entrance of the Circular Canal forming the head of the "overland cut" without a *lock*, the assertion met with in the 10th paragraph of his Minute,* "that the continuation of the Circular Canal will not in any way "affect the Drainage of Calcutta," would have been nearly correct. But as in the same paragraph, he remarked, that "the Drainage of Calcutta has always been an imperfect "operation," and concluded the sentence by observing, "The question does not belong to "this paper, and I will only generally say, that I think it susceptible of very great im- "provement," it may perhaps fairly be surmised that His Lordship did perceive that the construction of the Circuitous unlocked Canal would have necessitated the adoption of a totally different System of Town Drainage.

From the 6th paragraph of Sir Thomas Anbury's Minute, (page 49, Appendix G,) it appears, that he also had a perception that some kind of change of the System of Drainage would be expedient. The entire paragraph is thus expressed: "On the Drainage of Calcutta "as referrible to the filling up or reclaiming the Lakes, I conceive it has nothing to do, since "the Canal runs between the Town and the Western extremity of the Lake, but, on that "head, I should say, that a new *grand tunnel* or *trunk drain* should be constructed to "carry off all the Drainage of Calcutta towards Tolly's *Canal:* but that is quite another "question."

Here, adverting to what has been stated of the discharge of silt or sediment from the Town Drains entering the Circular Canal, and to the supplemental fact, that, with reference to the evidence given by Captain Thomson,† the total annual discharge of such silt from all the Town Drains cannot be estimated at less than 1,600,000 cubic feet, I deem it necessary to note, that in place of its being a matter of little importance *whether this amount of annual deposit* were carried into the Lake or past it by "a *grand tunnel* or trunk Drain" into Tolly's Canal, as the paragraph quoted would seem to imply, it, in fact, is in the highest degree desirable, that the silt in question should solely and exclusively be deposited in the Lake.

Were the great deposit treated of, carried into Tolly's Canal, by the means proposed by Sir Thomas Anbury, it could but have the effect of speedily rendering that valuable Channel useless for Navigation, but were it on the contrary conducted into the LAKE, it is almost obvious, and may fully be proved, that it would be one of the most beneficial appliances that could be brought in aid of any plan adopted for Silting or Warping up the Level OF ITS BED.

In illustration of this point it may be observed, that the great Feeder proposed by Captain Thomas Prinsep, (see pages 21 and 22, Appendix G,) and which is of the same description as that of which the cost was reported on by the Lake Committee, was estimated by him as calculated to convey from the Hoogly to the Lake, from the 15th of June to the 15th of October, 10,800,000 cubic feet of water per day. "The proportion of "sediment in the water of the (River) Hoogly at this season is, (he remarks) at present "unknown," but he subsequently observes, "it will bear no proportion with that in the water of the Ganges."—Now bearing in mind that at the period alluded to, an exceedingly erroneous opinion was entertained respecting the amount of alluvion or sediment borne by the Ganges water, a circumstance rendered evident by Lieut. Schalch's having represented,‡ "that some idea may be formed of it when" (he) stated the fact, "that in the rains the "stream" (the Hoogly branch of the Ganges being alluded to,) "carries with it *one-fourth* "of *its* bulk of *sand*," as also from the corresponding misconception of Major Hodgson,

* Page 4, Appendix G.

† Pages 67 and 72, Appendix D.

‡ NOTE.—See page 21 of Appendix A. I. to Appendix G.

§ Vide Appendix to Appendix G. page xxi. J. M.

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(then Surveyor General of India,) that in the rains the Ganges at Rajmahl* "rushes "on impetuously with an increased depth of 32 feet, *and charged with sand and mud "to the extent of one-fourth part of its volume.*" With reference to this error, Dr. Stewart observes, (page 147, Appendix D) "The absolute quantity of mud carried down by the "Ganges, and discharged by it along the coast, has been variously estimated. By "Rennel it was said *to be* 1 *part to* 4 *of water:* the extravagance of which estimate has "been forcibly shown by Lyell." Dr. Stewart further refers to "observations made "by the Reverend R. Everest, at Ghazeepore in 1831, and repeated the following year "during the rainy months;" observations which (as will be seen in the 1st. *volume* of the JOURNAL of the Asiatic Society, page 241,) proved that "the solid matter there discharged "by the Ganges was but $\frac{1}{856}$th. part of its bulk," and as, in concluding the account of the experiments that led to this result, the Reverend Mr. Everest has done me the favor to remark, that "in comparing these observations with some previous "ones (he) was glad to find that (his) average for the rains of $\frac{1}{850}$th part in bulk is "nearly the same as that obtained by Capt. Forbes, viz. 2 cubic inches in 1728 or "in 1 cubic foot." I deem it advisable to note that the experiments which led to the conclusion last mentioned, were made by me on the water of the great Ganges, (or Pudma,) between Surdah and Jaffiergunge (I think) in the year 1817; and that they were brought to notice in a Report, then furnished by me, on the *bunds, or embankments,* of the adjacent Rajshahee district; thus with a view to demonstrating the *inexpediency* of maintaining at great expense a line of upwards of 50 miles in length of these *works,* they having in reality but the pernicious effect of turning off from the extensive neighbouring inland Jheels and low Levels, the immense mass of fertilizing alluvion that even at the rate of 2 inches in the cubic foot of the water excluded, it was shewn would by the removal of the embankments have been admitted. Though this Report *thus adverted to a point of* much importance as concerned the Warping up of the Salt Water LAKE, viz. the quantity of alluvion obtainable for that purpose from the River water, it does not appear to have been referred to by Lord William Bentinck, or any other of the parties who wrote Minutes on the subject of ITS treatment.

Indeed the early filling up of the Lake being the object in view, it was obviously more convenient to take for granted that the River water contained $\frac{1}{4}$th of its bulk of alluvion, than to have instituted experiments which might have terminated by proving that, in lieu of $\frac{1}{4}$th *part,* less than $\frac{1}{800}$th, part ought to have been recorded. It being noted, that in "Ale and Beer measure" 864 pints make a Butt, it is sufficiently clear that the issue to have been submitted to trial was whether a Butt of the Hoogly water contained one quarter of Butt of mud, or merely $\frac{1}{864}$th *part, which, being* $35\frac{1}{4}$ cubic inches, is, as it happens, exactly a pint or $\frac{1}{864}$th part of 30,456 cubic inches, the total number of cubic inches in a Butt.

Assuming then, the quantity of alluvion in the Hoogly water to be 2 cubic inches in a cubic foot, which it assuredly does not exceed, it will be found that in the course of 4 months or 122 days, in the rains, the feeder estimated for by Capt. Thomas Prinsep, (pages 21 and 22, Appendix G,) would, at the rate of 10,800,000 cubic [feet] per day, have admitted from the Hoogly to the Lake (122 days 10,800,000 cubic feet) 1,317,600,000 cubic feet of water, which, at the rate of 2 cubic inches in a cubic foot, would in the 4 months have deposited 1,525,000 cubic feet of alluvion; further, it will be perceived that as "*during the remaining* 8 *months* the *Hoogly water contains no alluvial*† *matter,*" this would also have been the *annual* deposit from the feeder.

It has been above observed with reference to the evidence of Capt. John Thomson, that the total unobstructed annual discharge of silt or sediment from the Town Drains would be 1,600,000 cubic feet, and it hence appears that as this annual amount of deposit

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* NOTE.—See page lxxii. E. 13, Appendix G.

† See Captain T. Prinsep's Minute.

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rather exceeds that derivable by means of the feeder from the Hoogly water, it is at least as important to the filling up of the *Lake* that the Drain deposits should be conveyed into it, as that such a feeder should be formed.

Were the conjoint means of filling it up here alluded to, brought fully into operation, it will be seen that the *annual deposit* might be estimated at (1,600,000+1,525,000=) 3,125,000 cubic feet; and taking the area of the Lakes requiring Warping up to the depth of 2 feet to be 18 square miles, we are enabled to arrive at the conclusion that the period which would be required for the completion of the process would be 321 years.

It will moreover be seen, that if in the calculation the 1,600,000 cubic feet of silt or sediment brought down by the Drains were excluded, the time that would be occupied by the Feeder alone in filling in the Lakes (or Lake) would be 658 years.

The operation would in either case be greatly accelerated by the annual growth and decay of aquatic plants and vegetation in the Lakes, which would assuredly far more than compensate for the portion of silt brought down by the Town Drains, that (as some of them lead to the River) could not be conveyed into the Lakes.

With reference to these, and other considerations, I have to state in reply to the 1st sub-division of Query II, that no benefit would accrue to the Navigation by carrying a Circuitous Canal through dry ground to the Southward of the Lakes in place of leaving it, as now, in comparatively a straight line through them. Neither in reply to the 2nd, 3rd, and 4th sub-divisions of the same Query (II), do I think that either the Drainage of the Lakes or the Warping of them up, or the Drainage of Calcutta, would be facilitated, but the contrary, by the construction of such a Canal.

The evidence which has been referred to shews, I conceive, that the filling up of the Lakes has been materially retarded by the formation of the present Circular Canal; this partly from its having served to exclude from them much of the silt of the Town Drains, and partly from its having cut off the connexion which formerly existed between the Lakes and the alluvion-charged water of the Hoogly by the old Chitpore Nullah, and other outlets; evils which would only have been aggravated if the Circular Canal had been carried, as proposed by Lord William Bentinck, to the Southward of the Southern Lake, a site in which it would have conveyed into the deep water channel at the South-East end of the Lake, nearly all the Sediment of all the Calcutta, Chowringhee, Intally, &c. Drains, as well as whatever alluvion-charged Hoogly water was admitted into the head of the Canal at Chitpore; and it has already been shewn that the consequence of leaving this head without a Lock would have been the Inundation of the lower part of the Town during high water in the River for four months of the year, this in a manner that would have rendered it necessary to have changed the general direction of the Town Drainage, either (as proposed by Sir Thomas Anbury) by carrying it into Tolly's Nullah, or as mentioned by other parties, by conducting it into the Hoogly.

As however by either of these alternatives, all the alluvion admitted from the Hoogly water, and all the deposits of the series of Drains adverted to, would have been sent past, or away from the Lakes, in place of into them, it appears sufficiently evident that the construction of the Circuitous Canal could in no way have facilitated the filling in of the Lakes; but, on the contrary, would have been most essentially at variance with its early accomplishment.

A. 3. I believe the detailed information given in reply to this Query by Captain Boileau, to be correct.

His proposal for the "improvement, or rather perfecting of the present rude towing "path along the Lake Channel, by converting it into a carriage road for 5 miles between "Balliaghatta and Bhamunghatta," I have already adverted to; and I have only further

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to observe, that if the embankment required for such a road were conducted along the South side of the Canal, as was part of the plan of the Lake Committee, it could there easily be rendered subservient to the Warping up of the Southern portion of the Lake, which lying for three-quarters of the year *most to windward* of Calcutta, ought *I think to be* FIRST silted *up*; a measure that, it may not be unimportant to note, could with comparatively great rapidity, be effected by the construction of the Central (brick-rivetted) Canal and System of Sewerage proposed by me; works which would directly conduct into this Southern portion of the Lake nearly the entire deposits of the Drains of Calcutta, Chowringhee, Intally, Balligunge, &c. and which (from the Canal and Sewers being lined with masonry) would admit of the alluvion-charged water of the Hoogly being passed through them with a velocity far exceeding that any mud banked channel, or feeder, could bear;—a consideration that I conclude must accidentally have been overlooked by the unmedical authority, who talked of their STAGNANT Batavian unhealthiness.

When by these means the portion of the Lake adverted to had been reclaimed, the sediment of the Drains, and the Hoogly alluvion-charged water, could be passed under, or across the Lake channel into the portion of the Lake lying to the Northward of IT, where, retained by an embankment, *then formed* along the Northern side of the Lake Channel, they would in like manner (but more slowly from the greater extent of this part of the Lake,) produce a similar effect.

It will be observed that the measure described would carry the process of Warping up (contrary to what has hitherto been proposed) from the Southward to the Northward, a mode of proceeding, which, it appears to me, would be advisable, in as much as it *is not the Northern* but the SOUTHERN *portion* of the Lake that is most commonly found to windward of Calcutta. This mode of proceeding would also prevent the possibility of the Drainage of the cantonment of Dum-Dum,* and of the numerous villages adjacent, being impeded in a way likely in the rains to lead to their inundation, and consequent unhealthiness, by the admission of water from the Hoogly to the Northern extremity of the Lake for the purpose of submerging and *first* raising adjoining subdivisions of it, a measure which it is certain would render the contingency adverted to, by no means infrequent, if it has correctly been represented in page 11, Appendix G, of the Evidence, that the average " Level of Dum-Dum is as low as that of the lowest part of Calcutta."

Having referred to notes written in the year 1833, or about the period the Lake Committee's Report was in the course of preparation, I find that the matter of subdividing the Lakes by minor embankments was not then overlooked, but was omitted in the Report with reference to the consideration that attempting to lay down the precise position of such embankments would at once have given rise to a number of questions, or lawsuits, concerning the right of property in the ground, and relating to the fishings, salt works, passable boat channels, &c. connected with the *Lakes,* which (as it was then believed, there was a serious intention of commencing operations) it was considered might best be taken into consideration after the main, and in reality alone essential, embankments, those proposed along the sides of the Lake Channel, had beneficially been brought into action.

Other parties regardless of this contingency, appear to have recommended beginning with little embankments in the very quarters where they would have been most certain of giving rise to interminable litigation, viz. at, and around, the Northern extremity of the Lake, or, (as on other grounds I have been induced to consider it,) at the wrong end.

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* The necessity of forming a new channel to the Eastern Lake for carrying off the Drainage water from Dum-Dum, is adverted to by Captain Thomas Prinsep, with reference to the proposal for commencing the Warping up of the North-Western Lake at its Northern end.—W. N. FORBES.

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By the adoption of the course recommended by the Committee, the generally good effect of Warping up would have been well advanced before its progress reached the debatable or marginal lands, which, if first set to work on would probably have been found fruitful, but of vexatious and injurious delays.

Although that Committee's Report has been somewhat ungently criticised by Reporters, who professed not to understand it, there appears to be very general accordance in the opinion, that whatever else is done with a view to ameliorating the condition of the Lake, its Central Channel should, as suggested by the Committee, and as now recommended by Captain Boileau, be embanked.

A. 4. With reference to Query IV. I am of opinion that deepening and widening the present Lake Channel to such an extent as would render it by means of embankments and towing paths conveniently suitable for the purposes of Navigation, would not, on the plan proposed by me, be injurious to the Town Drainage; neither do I think that the enlargement of the Channel would materially interfere with the Drainage or Warping up of any portion of the Lake. Such widening and deepening would certainly in no way affect the silting up of the portion of the Lake lying to the Southward of the *Lake Channel, by the* Town Central Canal, side Sewers, and Hoogly water above alluded to, as the water transmitted to the Lake, having there deposited its alluvion, could still be allowed to discharge itself by the Byah Nullah, and other, untouched, deep Eastern outlets.

A. 5. This Query has virtually been answered by the opinion offered in reply to the three preceding questions.

No deepening or widening of the Lake Channel, supposing it (as it ought to be) embanked along its Southern side, could affect the system of Town Drainage suggested by me.

A. 6. I think that if the Canal entering the centre of the Town, forming part of the Plan or System referred to, were constructed, it would early be frequented by as many Saltees or small boats as it could conveniently accommodate.

A. 7. In reply to this Query, and with reference to Captain Boileau's answer to it, I have first to observe, that, if, as alluded to by him, "the Circular Canal were continued " behind Entally and Ballygunge into Tolly's Nullah at Bowaneepoor, which would form " a new line of Navigation 3¾ miles long, and would cost perhaps four lakhs of Rupees, " including all the necessary bridges and a large lock, but exclusive of the purchase of " ground," such a work would most materially interfere with the System of Town Drainage proposed by me; inasmuch as the extension of the Circular Canal would, if that system were carried into effect, receive the contents of the Town Drains, this in consequence of its being interposed between their main outlets and the Southern portion of the Lake, which, otherwise, their silt, added to alluvion derived from the Hoogly water, would have the effect of Warping up to a Level, adapting it for cultivation.

Additional space for the boats now crowded into Tolly's Nullah and the Circular Canal might be provided by placing such a large Lock as has been mentioned by Captain Boileau, at a spot in the vicinity of the Eastern end of the Balliaghatta Canal, *where*, being employed to keep the water in this Canal, and in the Circular one, nearly at the level of high water in the Hoogly, *it* would, by occasioning in these a considerable additional *depth of water*, proportionally increase their surface breadth, and consequently accommodation for boats.

The adoption of this plan, would, however, only be conveniently practicable after the

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Central system of Town Drainage had been opened, as then a portion of the water thus kept up in these Canals, so as to form an united *Reservoir,* might be allowed to flow from *it* into drains occupying the site of the Town Drains now entering the Circular Canal, but Drains then having (with a much greater fall) their bottoms so sloped to the Westward as to carry their contents into the covered side sewers running parallel to the brick-rivetted Canal passing centrically through the Town. Were it found (necessarily after far more deliberate investigation of all the details bearing on this point than I have it now in my power to bestow,) that the adoption* of such a plan would be practicable, it would have the highly beneficial effect of rendering to a considerable extent unnecessary the Steam Engine power proposed in my former Reports to be employed in throwing River water, by means of superficial aqueducts, into the upper or shallow ends of properly sloped and rivetted Town Drains; as with the River itself on the West side of the Town, and with the Circular Canal-tide elevated Reservoir described on the East side, it is obvious, that, without having recourse to Engine power, the River water could always twice a day, for a couple of hours, or for a time, before and after high water, be made to flow in large quantities from the circumference of the Town through a series of Drains such as have been shown in the sketch of Central Drainage, but having their upper ends sufficiently low, with their falls sufficiently great, to ensure their contents being carried quickly into, and rapidly through, the comparatively much lower covered side sewers of the Town Central Canal.

A. 8. I believe the statements made by Captain A. H. E. Boileau, in answer to this Query are generally correct, but I have found (and read,) Mr. Cardew's paper in the page indicated by the Query.

A. 9. In addition to the replies above given, in one of which I have explained the grounds on which I consider the cutting of a Canal from Entalee to Bhowaneepoor objectionable, I have only to state that, in conjunction with Colonel McLeod, of Engineers, I several months ago, prepared and forwarded to Government a Report on a line of Canal extending from Mirzapore on the Hoogly to Rajmahl on the Ganges, and which, accompanied by a carefully surveyed Topographical Plan, and by levelling sections, made with the utmost precision, showed that such a work would be easily practicable, and unquestionably profitable; partly from its affording the greatest possible facilities to the water communication between Calcutta and the Ganges, and partly from its serving to convey at cheap rates to either of its extremities, Coal, Iron ore, Stone adapted for building, and making roads, and other Minerals found adjacent to its course; viz. the Eastern base of the Rajmahl range of hills. This Canal having also been planned with a view to supplying water for the purpose of irrigation; the report further pointed out that it would enable large tracts of land, now lying waste, to be brought into profitable cultivation, this whilst its permanent navigability would enable their products such as Indigo, Sugar, Tobacco, Oil seeds, &c. to be cheaply conveyed to the great export outlet—Calcutta.

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* The adoption of this plan would also have the beneficial effect, by allowing an escape, through the Durrumtollah Drain, of the water in the Intallee Canal into the *Eastern* covered *side* sewer of Major Forbes' Central Canal, of removing a very *serious* and much complained of evil, viz. The stagnation which exists in the Intallee Canal, especially at its head or Western end, where the water is frequently perfectly putrid.

The noxious exhalations which arise at the head of this Canal, have ruined the health of many, and even believed to have caused the death of some, of the several Inhabitants who have resided in the immediate vicinity of the above locality. The above plan would also dispense, whilst it might allow of more room for Boats, with the necessity for the large Cess Pool or Silt Bason at the head of the Intallee Canal, and at the same time prevent in the Canal itself, the present great deposit of Silt, which it is stated necessitates the Canal being dug out every 4 or 5 years at an average *annual* expense, including the emptying the Silt Bason, of about Rs. 1,500.—J. M.

31*st Dec.* 1841.

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Answers by MAJOR *W. N.* FORBES, *(Engineers) to the Queries marked No.* II. *to which Answers were requested from* CAPT. *A. H. E.* BOILEAU, *by the Committee upon the Fever Hospital and Municipal Improvements.—Supra page* 5.

2nd Series of Answers.

A. 1. *Draining the Lowest levels* of the Salt Water Lakes, *apart from Warping them up,* would only be possible by Steam Engine power.

Having spoken to Captain Boileau, respecting that part of his reply to this question, which states, "I do not see any reason to doubt the practicability of Draining the Salt "Water Lakes, though I do not think the execution of it to be advisable." I find he means by it, (as is also explained by his Answer to the 4th Question of the Second series,) that he does not think it would be advisable to attempt "*Draining*" the Lakes in *contradistinction to* "*Warping them up,*" an opinion in which I concur.

In addition to the means of Warping up the Lakes by means of the Silt of the City Drains, and the alluvion of the water of the Hoogly admitted by the Central Drainage Canal proposed by me, and described in the replies given above, I conceive it would only be advisable to have straightened, widened, and in some places embanked, all the natural channels met with between Chitpore and the Powder Works at Ishapore, found, *during the season of inundation, partly* open from the Hoogly to the Northern end of the Lakes, this in conjunction with making the most Northerly of these channels pass through the main Drains of Dum-Dum and those of the adjacent villages, a measure that *carefully managed* might be made the means of improving their Drainage, by carrying a current of water through their principal outlets, and thereby sweeping into the Lakes nearly all the Silt either now periodically filling in these Drains, or serving to render them injuriously stagnant.

Were this suggestion adopted, the natural *channels* adverted to, would gradually enlarge themselves, and progressively convey to the Lakes the successive masses of earth and alluvion detached from their bottoms and sides; a process by which the Lakes would gain, as regarded Warping up, the benefit of the total cubic contents of the enlargement of the channels.

The progress of this process (necessarily regulated near the upper ends of the channels by sluices) would however require to be cautiously attended to, as it would obviously in time, have a tendency to conduct into the Lakes a greater body of the Hoogly water than would be desirable.

Compared with the expense of purchasing ground, and of excavating, bridging, sluicing, &c. a feeding channel of 200 square feet section, (estimated at four lacks of Rupees,) the cost of this mode of proceeding would be inconsiderable.

The proprietors of the ground on which the channels had enlarged themselves would, of course, be *entitled* to abatements of rent in proportion to the quantity of surface land abstracted; but as the paddy cultivation, and that of many other descriptions of crops would be benefitted by the freer admission of the alluvion-charged Hoogly water, it is probable this plan would, in *practice,* be found incomparably the cheapest method of effecting the admission of the mud-yielding water required.

Some of the Hoogly outlets or Channels alluded to, are exhibited by the sketch

No. IX.
Major W. N. Forbes, Engineers, 10th Aug. 1841.

plan furnished by the late Mr. Kyd, and found in the evidence facing page lxxxiii, (1)E. 15. Appendix to Appendix G.

Of course the operations adverted to concerning them, could only be beneficially carried into effect after the present Lake channel had been embanked; the embankment on the Northern side being provided with rivetted waste wears, over which the Hoogly, &c. water would flow into the Lake Channel after the water had deposited its alluvion.

A. 2. Nothing proposed by me *here*, or in the replies above furnished, would be in the slightest degree injurious to the system of Central Town Drainage recommended in my former evidence.

A. 3. Having attended Meetings of a Committee at the Government House on the subject of the Canal proposed by Lord William Bentinck, at the time he first brought it forward, and when he was Governor General, I no more approved of it then, than I do now. I conceive its construction would be utterly at variance with the proper Drainage of Calcutta, and that *ultimately*, or previous to his sanctioning the present Lake Channel and works connected with existing Canals, he must himself have arrived at a conclusion somewhat similar.

I do not find that after adequate consideration any Engineer in this country approved of his Plan; nor, with reference to the circumstances under which it was proposed, can I imagine there could have been any other than a predisposition to approve of it, if possible.

A. 4. I believe that by the means above described, or by various means, the Warping up of the Salt Water Lakes would not be difficult, and that it would in *every way* be advisable.

A. 5. Having above explained the manner in which it has appeared to me the Warping up of the Lakes could best be effected, I have only supplementally to observe, that I feel disposed, for reasons previously mentioned, to leave the planning and arrangement of the Minor Lake embankments to Revenue Officers, and the provisions (if such exist) of the law.

To save time in discussions relating to them, and for other reasons, I think it would be advisable to commence with the essential parts of the General Plan, embanking* the present Lake Channel, and facilitating the admission to the Lakes, from all possible quarters, of Drainage silt, and River alluvion.

A. 6. The looseness of the banks of the present Circular Canal would certainly not admit of its being employed to any great extent (*principally* depending on velocity of current) as a feeder. The Lake Committee *additionally* proposed a feeder from the Hoogly, having 200 square feet of section, a work in these replies repeatedly alluded to. In the reply to the 2nd Query of this, the 2nd Series I have pointed out the means by which the construction of such a costly channel, or Canal might be rendered unnecessary.

A. 7. I think that *rivetted* waste-wears, log-dams or overfalls, may, with advantage, be almost totally employed in place of sluices; it is however worthy of note, that sluices were considered necessary by Captain John Thomson, a Member of the Lake Committee, and then Superintendent of the Canals, and who it is well known was most intimately acquainted with the Local affections of the Lakes.

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* This measure it will be observed was approved of by Col. Craigie, by Sir Thomas Anbury, and by Col. Galloway. Capt. Boileau, the present Superintendent of Canals, now recommends its adoption; nor will it be overlooked that it formed a part of the Plan of the Lake Commitee not pretended to be misunderstood.

No. IX.
Major W. N. Forbes, Engineers, 10th Aug. 1841.

A. 8. I have already in various preceding replies, explained how I consider it would be advisable to admit the alluvion-charged River Water, and I have referred to portions of the Evidence, which prove, that its free admission is not of more importance than having conveyed into the Lake all the Silt of all the City, Dum-Dum, &c. Drains.

A. 9. I am of opinion, that the double fall afforded by the Central system of Drainage proposed by me, will be found indispensable to the effectual or healthful Drainage of the City and Suburbs.

A. 10. If the Central system of Town Drainage were adopted, all the Mud and Silt of the Town Drains would be kept clear of the Circular Canal, and be carried where (in place of doing mischief) it is required, into the Salt Water Lakes.

A. 11. I believe the *arithmetical* statements given in reply to this Question, by Captain Boileau, to be correct.

A. 12. I have often heard that the accumulation of filth alluded to, was considered a cause of great unhealthiness by the Inhabitants in the vicinity of the Entally Canal.

A. 13. The Salt Water Lakes present a dreary and desolate series of Marshes, laid more or less under water according to the state of the Tide and the season of the year. They are interiorly intersected by innumerable small Creeks, some of them of considerable depth communicating with the Lake Canal Channel, by about 30 small and 4 large outlets, which by reference to the Lake Committee's Report, page 38, No. VI. (B.) and to their Estimate, page 41, No. VI. (B 2,) (Appendix G.) it will be perceived, they recommended should be embanked, so as to afford (as is required) Towing-paths for the Canal, so as to exclude Salt Water from the Lakes; and so as to retain in them, until it has deposited its alluvion, (therefore so as to progressively Warp them up,) whatever Water charged with the Silt of the Town or that of other Drains, or with the mud and fertilizing contents met with in the freshes of the Hoogly, can be conveyed into them.

The fearful Insalubrity, if not Pestilentiality, of the alternately wet and dry surfaces, and vicinity of these Lakes, compared with that of rice cultivation *in Bengal,* had I conceived, been set at rest by the higher rate of Mortality they had been ascertained to induce.

It may however be hoped, that scepticism on this point will not lead to retarding their amelioration, and thereby to the perpetuation of evils, such, as under similar circumstances, Providence generally permits man the sense and energy to avert, if not from himself, from posterity.

I have the honor to be,
Your most obedient servant,
W. N. FORBES,
Major, Engineers.

CALCUTTA,
August 10*th*, 1841.

No. X.

No. X.
Col. W. N. Forbes,
Engineers, 18th
June, 1845.

Question put by the Committee upon Municipal Improvements, to Colonel W. N. Forbes, Engineers, and his Answer thereto.

Question. You have stated in your former evidence, that if the Circular Canal were continued behind Entally and Ballygunge into Tolley's Nullah at Bhowanypore, such a work would materially interfere with the system of Town Drainage proposed by you, for the reasons which you then gave, and which appear to the Committee to be satisfactory.

Captain Boileau has stated, that great obstructions are experienced from the number of Boats which lie in the Canal to discharge their cargoes, and that as a very important and perhaps most efficient remedy, he would propose that the Circular Canal be continued in the line above-mentioned, into Tolley's Nullah, which would form a new line of navigation.

If the continuation of the Circular Canal to Tolley's Nullah in the line proposed by Captain Boileau be abandoned, is there any other line which you can suggest for a communication between the Circular Canal and Tolley's Nullah, which would not interfere with the system of Town Drainage, proposed by you; or if not, what remedy would you propose for getting rid of the obstructions complained of, in the Canal, besides the excavating the small Docks here and there proposed by Captain Boileau?

Answer. The obstruction alluded to in the Circular Canal and in Tolley's Nullah, and proceeding from the want of sufficient accommodation for the craft frequenting them, might be remedied by the formation of Boat Basins, or Wet Docks lying in the line that would have to be given to the Circular Canal were it prolonged to Tolley's Nullah, but separated from each other in the situation where this line would be intersected by the Town-drainage Scouring Canal, and covered side Sewers proposed by me.

Thus formed, one of these Basins would answer for the reception of the vessels now impeding the navigation of the Circular Canal, and the other for the reception of the craft often at present stopping, and always retarding, the communication through Tolley's Nullah.

The Basin formed in continuation of the Circular Canal might, during the rainy season, be effectually scoured out by a current admitted into it from the Town-drainage Central Canal; and by the same means, and at the same season, the Basin terminating in Tolley's Nullah, might be similarly treated.

The large Channel of masonry and Sluices thus enabling the Basin connected with Tolley's Nullah to be scoured out, might also be conveniently adapted for furnishing an additional supply of water from the Nullah to the Town-drainage Canal; this whenever the tide in the Nullah was higher than the level of the water in that Canal.

Five feet of water should at all times of tide be preserved in this Basin, as also in the one forming an extension of the Circular Canal; and as this extension would be merely an open (or unlocked) prolongation of the Circular Canal, it would necessarily have the same level of surface.

By the arrangement suggested the "large lock," fitted with two pair of gates, which it was mentioned by Captain Boileau would have been requisite had the Circular Canal been extended as proposed by him to Tolley's Nullah, could be dispensed with, as the land left between the Basins described, and formed into Wharfs in the vicinity of the Town-drainage Canal, would prevent the levels of the Circular and Lake Channel from being affected in the manner intended to be prevented by the large lock.

Having re-examined the levels with a view to ascertaining whether the Town-drainage Canal, and side Sewers, could have been safely carried under the Circular Canal, if the prolonged portion of it had had its water surface constantly kept up by locks at each end to the level of high water in Tolley's Nullah, I find that the general drainage of the Town could not even by this expensive means have been as uninterruptedly kept up as it assuredly is necessary it should be.

It may indeed further be noted, that even had the prolongation of the Circular Canal been provided with locks adapted for keeping up its surface to the level of the highest tides in Tolley's Nullah, these tides are in the dry months so low, that unless the central Drainage Canal, or at all events its large side Sewers had been made to descend through metal trunks rising again from under the prolonged Circular Canal, the navigation of the latter Channel could not in the dry season have been maintained.

The cost of such metal trunks would inevitably have been very considerable, and from their inverted arch-form, there would obviously have been such a risk of their occasionally getting choked up by the contents of the Sewers as could not safely have been encountered, when the entire Drainage of the Town had been made to depend on the currents passed through them.

Seeing, however, that boats cannot often have occasion to circumnavigate Calcutta, I believe it will readily be admitted that any convenience which could have been derived from their having been enabled to do so would have been dearly purchased if obtained (as it only could have been) in a manner that would have broken the continuous scour through the main Town sewers to the Salt Water Lake.

It may moreover be observed, that under any circumstances the cargoes of boats entering either the Circular Canal or Tolley's Nullah, would have had to have been unloaded, before they could have been transferred to the " Saltees" or small boats adapted for navigating the Central, or Town-scourage Canal.

Mint,
June 18th, 1845.

W. N. FORBES,
Lieut. Colonel, Engineers.

No. XI.

No. XI. Queries, 4th June 1845.

Queries to which Answers are requested by the Municipal Committee, relative to a Canal to Channel Creek and the continuing of the Canal through the Salt Water Lake from Hoseinabad, as proposed by the late Major Schalch.

Q.—1st. Whether Ships could, with any convenience or advantage, proceed from Sea up Channel Creek, there to discharge their cargo for transmission to Calcutta by Boats?

2nd. Whether in the present state of the Trade, and of the Shipping resorting to the River Hoogly, and taking into consideration the use of Steam-tugs, any, and what advantage would be derived from enabling ships to discharge their cargoes at the New Anchorage, or Diamond Harbour, for transmission from thence to Calcutta by Boats through a Canal independent of the higher part of the Hoogly?

3rd. What are the advantages to be expected from continuing Major Schalch's Canal from Hoseinabad to Coolna, in reference to the Trade with the Upper Provinces; and is there any difference at present in the delay, difficulty, and danger of Boats coming from thence by the existing circuitous routes, as compared with the difficulty, and danger, which existed when that Canal was proposed in 1822?

4th. What is the amount of the Trade between Calcutta and Dacca, Chittagong, Sylhet and places adjacent, which is now carried on through the Soondurbuns to Tolley's Nullah; what are the difficulties and dangers of the present line of communication; and what advantages would be derived to this Trade from the completion of Major Schalch's Canal to Coolna?

5th. If a Canal from Tolley's Nullah to Channel Creek, as proposed by Major Schalch, were carried into execution, would the Trade from these last mentioned places, and from which of them, come by it to Tolley's Nullah; and with what, if any, advantages over its present route by the tortuous Channels of the Soondurbuns?

No. XII.

No. XII.
J. Beckwith, Esq.
25th June 1845.

Answers by J. Beckwith, Esq. to the Queries put to him by the Municipal Committee, printed at page 99 *of this Appendix, and marked No. XI.*

No. 1. Cannot answer this question.

No. 2. In the present state of Trade, as vessels would discharge their cargoes at the New Anchorage or at Diamond Harbour, and as regards the *external* commerce of the country, a Canal from Tolley's Nullah to Channel Creek would be of no use. In 1822 a large portion of the external trade was carried on by the E. I. Company in very large vessels that discharged stock in cargo at Diamond Harbour or Saugor, and a communication between Calcutta and Diamond Harbour or Channel Creek would then have been of great benefit; but now, from the smaller size of the vessels employed, and the greater ease and safety of the navigation from the employment of Steam-Tugs, every vessel comes off Town, and would continue to do so, if there was the most perfect Canal communication to an Anchorage at Diamond Harbour or Channel Creek.

No. 3. The Trade with the Upper Provinces is now carried on by the Bhagaruttee River entirely during six months of the year, and to a great extent during the remaining period; the larger sized Boats only coming through the Soondurbuns in March, April and May: there is not much danger in the Soondurbun route, but the rate of hire of boats is higher in consequence of the greater delay and increased distance. The measures required to facilitate the communication with the Upper Provinces are any of the following:—The improvement of the Bhagaruttee; the completion of the proposed Canal to Rajmahal, or of a Railway to the same point. There is no chance of a Canal from Tolley's Nullah to Koolna receiving any support as a means of improving the communication with the Upper Provinces.

No. 4. Cannot give any precise information as to the Trade between Calcutta and Dacca and places to the eastward.

No. 5. Answered in No. 3.

Calcutta,
25*th June*, 1845,

J. BECKWITH.

No. XIII.

No. 2033.

No. XIII. Clerk to the Committee, 5th June, 1845.

To CAPTAIN W. RUTHERFORD,
Superintendent of the Calcutta Canals, &c. &c. &c.

Sir,

By desire of the Chairman of the Municipal Committee, (the Hon'ble Sir J. P. Grant,) I have the honor to transmit the enclosed printed Queries, relative to a Canal to Saugor, proposed by the late Major Schalch, and the continuing of his Canal from Hoseinabad to Koolna, and to request the favor of your Answers to them at your earliest convenience. The Committee will also be obliged by your favouring them with a Return of the number of Boats paying Toll, which have entered the Circular Canal for the years 1841-42-43 and 1844, *distinguishing* those which have entered the said Canal from the *Salt Water Lake*, and those which entered it from the *River Hoogly.*

I am also directed to request you to be so good as to state whether the Pucka Road along the North Bank of the Balliahghatta Canal, mentioned by Captain Boileau in January 1841, has been completed, or if not, to what extent it has proceeded.

I beg to enclose for your information, a printed copy of the evidence given by Captain Boileau to the Municipal Committee, in which you will find at end of Captain Boileau's Answer to Query 3rd, notice of the Pucka Road referred to in the above Question by the Committee.

I have the honor to be,
Sir,
Your obedient servant,
(Signed) J. MORRIS,
Clerk to the Committee.

Municipal Office,
Town Hall,
5th June, 1845.

No. XIV.

No. 16.

No. XIV. Capt. W. Rutherford. 28th June, 1845.

To J. MORRIS, ESQ.
Clerk to the Municipal Committee.

Sir,

In accordance with the request of the Chairman of the Municipal Committee conveyed in your letter, dated the 5th instant, I have the honor to forward answers to the queries contained in the printed paper No. X., which accompanied your communication.

I beg likewise to transmit two* Returns marked A and B, shewing the number of boats paying toll, which have entered the Circular Canal and Tolley's Nullah, for the years 1841-42-43 and 44, distinguishing those which have entered the former Canal from the Salt Water Lake, from those which have entered by the river Hoogly; and in like manner the number of boats navigating the Nullah from the Soonderbunds and from the Hoogly, respectively.

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* These Returns are embraced in the Return annexed to a subsequent communication received from Capt. Rutherford, and marked No. XVI. *a.* in this Appendix.—J. M.

No. XIV. Capt. W. Rutherford, 28th June, 1845.

With reference to the Pucka Road on the north bank of the Belliaghatta Canal, adverted to in your second paragraph, the recommendation of Captain Boileau to continue it on to the Salt Lake has not been carried into effect. Three thousand five hundred feet of Pucka Road along this line was completed by Captain Boileau in 1841, and the remaining portion still remains Kutcha for a distance of 5,000 feet to the Toll house on the margin of the Lake.

I have the honour to be,
Sir,
Your most obedient servant,
W. RUTHERFORD, *Captain,*
Executive Officer of Canals.

CALCUTTA,
28th June, 1845.

No. XIV. *a.*

Ditto No. XIV.*a.*

Answers by Captain W. Rutherford, Executive Officer of the Calcutta Canals, to the Queries put by the Municipal Committee, printed at page 99 *of this Appendix, and marked No. XI.*

Answer. I am not competent to speak of the advantages, especially with reference to the safety of ships proceeding up Channel Creek; but from what I can learn on the subject, the general feeling, amongst consignees or shippers of goods, is against ships resorting to that Harbour, from whence they consider the transmission of cargo by Boats to be objectionable.

A. 2. I believe it may be taken as a general rule that the nearer a ship discharges her cargo to the place of delivery, the better; and it may be further admitted that a ship lying off Calcutta is in a safer berth than at the New Anchorage or Diamond Harbour. Taking into consideration therefore the use of Steam-Tugs, I conceive the purposes of a Canal for the transmission of goods from these places to be entirely superseded, as few or no merchants would avail themselves of such a mode of conveyance so long as they can receive and ship goods at once off Calcutta, under the existing steam arrangements.

A. 3. I am only imperfectly acquainted with the locality of Major Schalch's proposed Canal from Hoseinabad to Coolna, but I do not anticipate any benefit to the Trade of the Upper Provinces at all proportionate to the expense its execution would involve. The dangers and difficulties of the existing route, whatever may have been the case in 1822, are now seldom or ever heard of.

A. 4. The only data, as regards the amount of trade now carried on through the Soondurbuns to Tolly's Nullah, which I am able to furnish, is contained in the accompanying return marked B. shewing the number of Boats which have passed through that Channel, between the Soondurbuns and Calcutta in the years 1841-42-43 and 44. It is impossible for me to say what amount of trade has been carried on from the places indicated in the query, as no questions are ever asked at the Toll stations, and no records are kept, from whence Boats have come, or whither they are bound. The Navigation of Tolly's Nullah has been greatly improved in the course of last year by the removal of a dangerous sand bank at its junction with the Kamrapookeriah Khal, where the Nullah has been deepened four feet, for a distance of 2000 feet westward. I am not aware that any other difficulties or dangers exist on this line, of sufficient magnitude, to render it expedient to excavate the Canal proposed by Major Schalch to Coolna; nor can I speak as to what advantages would accrue to Trade thereby, although I do not think their amount would be in any degree commensurate with the expense likely to be incurred.

Ditto No. XIV.*a.*

A. 5. I have no doubt that many Boats from Dacca and Chittagong would find their way through the proposed Canal from Channel Creek to Tolly's Nullah, but I am unable to say with what advantages over the present route; owing to the very imperfect acquaintance I possess with the line of Navigation proposed by Major Schalch.

Calcutta,
27*th June*, 1845.

W. RUTHERFORD, *Captain*,
Executive Officer of Canals.

No. XV.

No. 2042.

No. XV.
Clerk to the Committee, 2nd July, 1845.

To CAPTAIN W. RUTHERFORD,
Superintendent of the Calcutta Canals.

Sir,

I am directed by the Hon'ble Sir J. P. Grant, Chairman of the Committee upon Municipal Improvements, to request you to favour him as early as possible with a statement exhibiting the amount of Tolls derived from each of the following Canals, viz., Tolley's Nullah and the Circular and the Balleahghatta Canals in each year, as also the expenditure, since the period the Tolls came under the Military Board's management in May or December 1836, up to the current year, specifying the rates of Tolls in each year or changes in the amount of the Toll levied and the dates of such changes, also a Return* of the number of Boats paying Toll which have entered the above Canals during the period they have been under the Board's control, viz., since December 1830, distinguishing those Boats which have entered the Canals from the Salt Water Lake, and those which have entered them from the River Hoogly.

The information respecting the Tolls you will possibly be able to compile from your annual Statement or Account Currents to the Military Board.

I have the honor to be,
Sir,
Your most obedient servant,
(Signed) J. MORRIS,
Clerk to the Committee.

Municipal Office,
Town Hall,
2*nd July*, 1845.

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* The Committee desire to complete the Returns of 1841 to 1844, received with your letter to my address of the 28th ultimo.

No. XVI.

No. 24.

No. XVI.
Capt. W. Rutherford, 16th July, 1845.

To J. MORRIS, ESQ.
Clerk to the Municipal Committee.

Sir,

In compliance with the request of the Hon'ble Sir J. P. Grant, Chairman of the Municipal Committee, conveyed in your letter No. 2042, dated the 2nd instant, I have the honor to forward a figured Statement of the number of Boats which have entered the Calcutta Canals, and of the amount of Tolls levied thereon, from the 1st November 1836 to the 30th April 1845, the period which this branch of Revenue has been under the control of the Military Board.

2nd. The Statement exhibits a return of the proceeds for the first half year, viz. from 1st November 1836 to 30th April 1837, and from the latter date annually up to the 30th April of the current year, shewing the gross amount of collections at each Station on the Circular Canal and Tolley's Nullah, as also the aggregate amount of Revenue derived from the Tolls during the whole of the above period.

3rd. In the column of remarks I have inserted the rate of Tollage for each year, which was reduced from one Rupee to eight Annas per 100 maunds on the 1st May 1838, agreeably to G. O. P. C. under date the 24th April of the same year.

4th. Under the head of " Tolley's Nullah" will be found included, the small subsidiary station of Russa, established on the 1st October 1839, which yields an annual Revenue of from 3 to 4000 Rupees from a toll levied on Canoes which ply between the Soonderbund Creeks and Tolley's Nullah, falling into the latter by the Kamrapookeriah Khal without going near either of the principal stations at Panspotta and Kiderpore, and by this means payment of Toll was evaded until a branch of the Panspotta establishment was transferred to Russa at the mouth of the Khal.

5th. It will be seen by the returns of the current year, that the Tolls are in a more prosperous state than they have been hitherto, and that the increase has been derived from the Circular Canal alone. This must in some degree be attributed to the passage through Tolley's Nullah having been closed from the month of December to the 3rd of March last, pending the removal of a Sand-bank near the Kamrapookeriah Khal, which occasioned a much greater number of Boats to pass through the Circular Canal than usual.

6th. With advertence to the information required by Sir J. P. Grant, relative to " Expenditure since the Tolls came under the Military Board's management," I shall be obliged by his informing me what expenses are meant to be included under that head, whether it refers to the expense of keeping up the Toll establishment *alone*, or to the *whole Canal expenditure* including the construction of *Roads, Bridges, Docks, &c. &c.* since 1836. If the latter, it will require some time to prepare a correct account, my office establishment being very limited (only sufficient to carry on the current duties,) and the records not in the most perfect state. I shall, however, be happy to supply all the information on the subject that may be within my power to obtain.

I have the honor to be,
Sir,
Your most obedient servant,
W. RUTHERFORD, *Capt.*
Executive Officer of Canals and Collector of Tolls.

Calcutta,
16th July, 1845.

No. XVI. *a.*

Return of the number of Boats navigating the Circular Canal and Tolley's Nullah, and amount of Tolls levied thereon, from 1st November* 1836 *to* 30*th April* 1845.

	Circular Canal.				Tolley's Nullah.							
	Dhapa.		Cheetpoor.		Panspotta.		Kiderpoor.		Russa.			
	Boats entered from the Salt Water Lake.	Amount of Tolls.	Boats entered from River Hoogly.	Amount of Tolls.	Boats entered from the Soonderbunds.	Amount of Tolls.	Boats entered from the River Hoogly.	Amount of Tolls.	Canoes entered from the Kamrapookeriah Khal.	Amount of Tolls.	Total amount of Tolls, and Grand total, from 1st November 1836 to 30th April 1845.	REMARKS.
From 1st Nov. 1836 to 30th April 1837.	23,190	34,887 12 6	5,705	9,890 8 0	11,257	36,230 3 3	5,872	26,499 6 0	.. ..	.. ..	1,07,507 13 9	Rate of Toll one rupee per 100 mds.
,, 1st May 1837 to 30th April 1838.	42,089	73,078 14 0	9,016	17,554 7 0	14,770	43,331 3 6	10,401	26,604 4 6	.. ..	.. ..	1,60,568 13 0	Ditto, ditto, ditto.
,, 1st May 1838 to 30th April 1839.	32,919	29,652 15 4	8,430	7,753 4 0	11,546	17,150 5 6	9,509	11,362 8 11	.. ..	.. ..	65,919 1 9	Rate of Toll eight annas per 100 mds.
,, 1st May 1839 to 30th April 1840.	49,919	52,674 8 3	14,312	18,793 6 6	19,500	29,593 15 0	13,200	17,480 11 9	19,832	2,620 8 6	1,21,163 2 0	Ditto, ditto, ditto.
,, 1st May 1840 to 30th April 1841.	69,200	79,007 13 6	17,145	24,357 1 6	23,000	35,359 13 6	15,430	22,517 14 9	26,579	3,687 1 9	1,64,929 13 0	Ditto, ditto, ditto.
,, 1st May 1841 to 30th April 1842.	68,830	80,719 11 0	14,960	22,208 10 0	20,990	33,056 13 6	13,915	19,194 2 3	29,045	4,066 0 3	1,59,245 5 0	Ditto, ditto, ditto.
,, 1st May 1842 to 30th April 1843.	67,350	83,784 2 0	12,405	20,825 6 9	26,380	32,165 2 0	12,700	17,419 12 9	33,835	4,561 2 6	1,58,755 10 0	Ditto, ditto, ditto.
,, 1st May 1843 to 30th April 1844.	63,930	90,196 5 0	14,090	25,343 15 3	19,105	28,682 7 6	11,850	16,343 2 9	27,455	3,727 0 6	1,64,292 15 0	Ditto, ditto, ditto.
,, 1st May 1844 to 30th April 1845.	68,300	1,04,003 2 9	17,760	34,742 4 0	13,275	22,315 3 3	10,135	13,237 8 9	25,510	3,493 9 3	1,77,791 12 0	Ditto, ditto, ditto.
	4,85,727	6,28,005 4 4	1,13,823	1,81,468 15 0	1,59,823	2,77,885 3 0	1,03,012	1,70,659 8 5	1,62,256	22,155 6 9	12,80,174 5 6	

CANAL OFFICE, CALCUTTA,
15*th July*, 1845.

W. RUTHERFORD, *Capt.*
Collector of Canal Tolls.

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* The Returns previous to the 1st November 1836, will be found printed in Appendix (I) pages 59 to 65 inclusive.—J. M.

No. XVII.

No. 29.

To J. MORRIS, ESQ.
Clerk to the Municipal Committee.

SIR,

In continuation of my Letter, No. 23 [24] of 16th ultimo, and with reference to your, No. 2052 of the 21st idem, I have the honor to forward, for the information of the Chairman of the Municipal Committee, a Statement of the annual Expenditure incurred on the Calcutta Canals, from the date on which the Tolls were placed under the control of the Military Board in November 1836.

The monthly current Bills of the Canal Department include the aggregate expences of Tolly's Nullah and the Circular Canal, which are under one and the same management, having an office establishment as well as other items of expenditure, common to both ; and I am therefore unable to furnish *separate* statements of the *whole* expenditure on each respectively, as requested in your letter. But I have done so, as far as is practicable, with regard to the cost of works executed agreeably to separate Estimates.

The discrepancy pointed out in your 2nd paragraph on [in] the two Returns of the number of Boats formerly transmitted by me, I am at a loss to account for ; as the figures in both of my office copies exactly correspond, being 67,350, which, although the correct number, does not accord with *either* of those indicated in your marginal reference, which are 67,360 and 67,550. It is possible therefore a clerical error may have occurred in your office as well as in mine.

I have the honor to be,
Sir,
Your most obedient servant,
W. RUTHERFORD, *Captain,*
Executive Officer Canals, and Collector of Canal Tolls.

CALCUTTA,
5th August, 1845.

No. XVII. *a.*

Return of the Annual Expenditure on the Calcutta Canals, from November 1836 *to April* 1845.

	Estimated repairs of Tolly's Nullah.	Estimated repairs of Circular Canal.	General Current Expenditure, including Establishment, Dredging expences, Petty repairs, and miscellaneous charges.	Total Annual amount Expenditure Canal Department & Grand Total.	Remarks.
From Nov. 1836 to April 1837..	1,972 12 11	12,611 3 5	13,783 12 7	28,367 12 11	Under the head of General Current Expenditure, the construction of dredging Boats, the repairs of Tow-paths and clearing of Jungle on the Soonderbund Canal, are included, as likewise all other items in the Canal Dept. which cannot be separately returned under the head of Tolly's Nullah or the Circular Canal.
,, May 1837 to April 1838..	.. .. ..	1,711 5 6	20,823 15 11¼	22,535 5 5¼	
,, May 1838 to April 1839..	1,946 14 1	19,594 10 11	27,325 3 4½	48,866 12 4½	
,, May 1839 to April 1840..	594 0 ¾	766 15 0	23,310 11 5¾	24,671 10 6½	
,, May 1840 to April 1841..	739 4 8½	2,654 13 3¾	22,890 0 3	26,284 2 3¼	
,, May 1841 to April 1842..	813 15 5¾	5,209 11 5¼	23,484 12 10¼	29,508 7 9¼	
,, May 1842 to April 1843..	2,004 9 6¾	1,262 11 9	22,903 4 11¼	26,170 10 3	
,, May 1843 to April 1844..	1,852 6 1½	9,014 11 11½	21,852 6 8¾	32,719 8 9¾	
,, May 1844 to April 1845..	3,926 7 10	8,307 7 4	25,518 15 7¼	37,752 14 9¼	
	13,850 6 9¼	61,133 10 7½	2,01,893 3 9	2,76,877 5 1¾	

W. RUTHERFORD, *Capt.*
Executive Officer Canals, and Collector of Canal Tolls.

CALCUTTA, CANAL OFFICE,
5th August, 1845.

No. XVIII.

No. 2073.

TO CAPTAIN W. RUTHERFORD,
Superintendent of Canals.

Sir,

Under instructions received from the Chairman of the Committee upon Municipal Improvements, I have the honor to request that you will favour the Committee, at your earliest convenience, with a Statement exhibiting under distinct heads the Annual Income derived from the Ferries, Fisheries, Fines, Hauts, or Bazars, Soondurbun Canals and Tolley's Nullah Lands, and any other source of Revenue (excepting that derived from Canal Tolls, a Statement of which you have already furnished to the Committee) that may have been, and is now, derived from the Canals under your charge from the earliest period to the present time.

I have the honor to be,
Sir,
Your most obedient servant,
(Signed) J. MORRIS,
Clerk to the Committee.

Municipal Office,
Town Hall,
The 13*th September*, 1845.

No. XIX.

No. 2074.

TO M. CROW ESQ.
Officiating Deputy Collector of Calcutta.

Sir,

The Committee upon Municipal Improvements, acting under the authority of Government, will be obliged by your furnishing them at your earliest convenience with *separate* Statements exhibiting the rent derived from the Lands and Hauts, or Bazars, pertaining to the Circular, Balleahghatta, and Entally Canals and Tolley's Nullah and Soondurbun Canals, from the earliest period to the present time.

I have the honor to be,
Sir,
Your most obedient servant,
(Signed) J. MORRIS,
Clerk to the Committee.

Municipal Office,
Town Hall,
The 13*th September*, 1845.

No. XX.

No. 198.

To J. MORRIS, ESQ.
Clerk to the Municipal Committee.

Sir,

I have the honor to acknowledge the receipt of your Letter No. 2074, of the 13th instant, and to request the favor of your explaining in detail the nature of the information sought by your Committee.—For instance, there are several Bazars along the Circular Canal, indeed more than half its length is studded with shops; but the tenure on which these lands are held, is a temporary farming Lease; the Dan Tolah and other profits of the Bazars and Shops being taken by the farmers.—Does your Committee desire to know the rent paid by this Mehal, which includes not only Bazars and Shops, but Ryutty and other lands also, on the produce of each Shop derived by the farmers? The former information can be easily given, the latter can be obtained only from the farmers, who will do all in their power to mislead an inquirer [any inquiries] into their profits. Were you to state the end for which this information is sought, I might better be able to furnish you with the means of obtaining that end.

2nd. Soonderbun Canals are not under the charge of this Office; and Tolly's Nullah is so only in part.

I have the honor to be,
Sir,
Your most obedient servant,
M. CROW,
Officiating Deputy Collector.

Calcutta,
Deputy Collector's Office,
The 15*th September*, 1845.

No. XXI.

No. 2076.

To M. CROW, ESQ.
Officiating Deputy Collector of Calcutta.

Sir,

In reply to your communication, dated the 15th instant, I have the honor to state, that the information required by the Committee upon Municipal Improvements, from your Office, is the amount of Revenue derived by the Government from the Surplus Canal Lands, including Tolley's Nullah, so far as the Lands pertaining to that Nullah are under your charge.

2nd. The Committee do not desire to know what the profits are of the farmers of the Bazars or Shops, or of Lands, but rather what they pay to the Government, in the shape of rent, either for Bazars, Shops or Ground rent. The Committee apprehend that the only Revenue derived from the Lands of the Circular and Balleaghatta Canals, is from the

Ground rent, and not from Bazars, Shops, &c. which possibly in no case have been built by Government, but by the parties renting the Lands. The Committee, however, understand that the same is not the case with respect to the Lands pertaining to Tolley's Nullah, which they learn contains several Bazars, Hauts, or Markets, formed or *erected by* the projector of the Nullah, Col. Tolley, and which, when the Nullah and its Lands came into the Company's possession in 1804, were transferred to the Company, who it is stated, farm them out.

3rd. The object of the Committee is to ascertain the *total* amount of Revenue, from all sources, derived by the Government from the Calcutta Canals and from the surplus Canal Lands. The Committee have been furnished by the Superintendent of Canals and from the Office of the Military Board, with a complete Statement of the amount of Tolls derived from the Calcutta Canals, including Tolley's Nullah, from the earliest period to the present time.

I have the honor to be,
Sir,
Your most obedient servant,
(*Signed*) J. MORRIS,
Clerk to the Committee.

MUNICIPAL OFFICE,
TOWN HALL,
The 18*th September*, 1845.

No. XXII.

No. 3005.

To CAPTAIN W. RUTHERFORD,
Superintendent of Canals.

SIR,

I am directed by the Honorable Sir J. P. Grant, Chairman of the Committee upon Municipal Improvements, to request the favor of your early reply to my Letter to you of the 13th September last, relative to the Revenue derived from Ferries, Fisheries, Fines, Hauts or Bazars and Canal Lands, &c. as the Chairman is busily engaged in framing the Report of the Committee on the Calcutta and Soondurbun Canals, which Report is now passing through the press.

The Committee observe in your Letter of the 16th July last, No. 24, to my address, that you mention that the Toll Station at Tolley's Nullah called Russa, only yields a Toll of 3 or 4,000 Rupees per annum, whereas the Committee notice in a Letter dated the 5th of December 1836, from Captain J. Thomson, then Superintendent of Canals, to the Military Board, that he states " that up to the 12th November 1836, a Toll of 4 annas was " collected from every loaded Boat or Saltee that navigated the Kumapookria Khal, and " the annual produce of this Toll has been estimated at 10,000 to 8,000 Sicca Rupees; that " if the Board are of opinion that the Khal forms or may be considered as a part of " Tolly's Nullah, which it is very necessary it should be, that he will in that event levy a " Toll on the same."

The Committee will be much obliged by your stating whether the decrease in Toll from the Russa Station is to be attributed to a change in the rate of Toll, or to what cause.

The Committee will be further obliged by your informing them, whether the information was ever furnished which was called for in the Military Board's Letter, dated the 25th October 1836, to the Superintending Engineer Lower Provinces, wherein he was directed to call upon the Superintendent of Canals to submit a Section of the Gobra Khal, and a Plan and Section of the Dam which he proposed to construct, and if so, whether any thing resulted in respect to the above subject.

I have the honor to be,
Sir,
Your most obedient servant,
(Signed) J. MORRIS,
Clerk to the Committee upon Municipal Improvements.

MUNICIPAL OFFICE,
TOWN HALL,
11*th November,* 1845.

No. XXIII.

No. 188.

To J. MORRIS, ESQ.
Clerk to the Municipal Committee.

SIR,

With reference to your Letter No. 3005, dated the 11th instant, I have the honor to forward, for the information of the Honorable Sir J. P. Grant, Chairman of the Municipal Committee, a Statement exhibiting the annual Revenue derived from Ferries, Fisheries, Ground Rents, &c. on the Calcutta and Soonderbund Canals, from the year 1836-37, to the 30th April 1845.

2. Adverting to the 2nd and 3rd Paragraphs of your Letter under reply, it does not appear, as regards the amount of Toll taken at Russa, that Captain Thomson's proposal, dated 5th December 1836, to levy 4 annas on every loaded Boat or Saltee that navigated the Kamrapookerea Khal, was ever carried into effect, as it was subsequently reported to the Military Board by that Officer, that nine-tenths of these boats were under 25 maunds burthen, the lowest rate of Tonnage, on which, by the Toll Regulations then framed and still in force, Toll is leviable.

3. It was not therefore until October 1839, that a Station subsidiary to Panspota, was established at Russa, as stated in the 4th para. of my Letter No. 24, of the 16th July last, when a Toll of 2 *annas* on all Canoes or Saltees equal to 25 maunds burthen passing through the Kamrapookeria Khal was levied, and which continues to yield a Revenue of from 3 to 4,000 Rupees per annum.

4. In respect to the project for damming the Gobra Khal, it appears that the information furnished to the Military Board by the late Captain Thomson, in compliance with their Letter of the 25th October 1836, was not of a nature to satisfy the Board of its expediency, and they accordingly withheld their recommendation to the execution of the work.

I have the honor to be,
Sir,
Your most obedient servant,
(Signed) W. RUTHERFORD, *Captain,*
Executive Officer Canals.

CALCUTTA,
17*th November,* 1845.

No. XXIII. *a.*

Statement of the Annual Revenue derived from Ferries, Fisheries, and Ground rent, &c. on the Calcutta and Soonderbund Canals, from the year 1836-37 *to* 30*th April* 1845.

Year.	Tolly's Nullah Ferry Rent.	Tolly's Nullah Fishery Rent.	Circular Canal Ferry Rent.	Circular Canal Fishery Rent.	Baliaghatta Dock Fishery Rent.	Chaltabariah and Bhangor Canal Ground Rent.	Ghonee Maugee Canal Ground Rent.	Fines, &c.	Annual Total.	REMARKS.
1836-37, ..	133 0 3	25 0 0	72 12 0	34 2 10	.. .. ..	.. .. ..	.. .. ..	.. .. ..	264 15 1	
1837-38, ..	107 10 0	150 0 0	121 8 0	204 15 10	.. .. ..	.. .. ..	15 12 0	142 6 0	742 3 10	
1838-39, ..	107 10 0	150 0 0	124 0 9	178 14 4	.. .. ..	200 0 0	63 0 0	.. .. ..	823 9 1	
1839-40, ..	113 11 6	202 8 0	127 3 0	206 4 0	.. .. ..	160 0 0	63 0 0	1,387 11 2	2,260 5 8	
1840-41, ..	132 0 0	343 1 1	127 3 0	210 0 0	.. .. ..	160 0 0	63 0 0	920 4 3	1,955 8 4	
1841-42, ..	132 0 0	290 0 0	208 2 3	210 0 0	112 14 8	160 0	63 0 0	1,602 12 1½	2,778 13 ½	
1842-43, ..	176 4 0	298 0 0	474 12 0	250 8 0	271 0 0	269 2 8	94 2 8	824 11 9	2,658 9 1	
1843-44, ..	239 4 0	349 8 0	579 0 0	322 0 0	271 0 0	341 10 8	96 0 0	906 6 1	3,104 12 9	
1844-45, ..	220 8 0	296 4 0	672 0 0	264 12 0	271 0 0	260 2 8	96 0 0	777 0 ½	2,857 10 8½	
Grand Total,	1,361 15 9	2,104 5 1	2,506 9 0	1,881 9 0	925 14 8	1,551 0 0	553 14 8	6,561 3 5	17,446 7 7	

(*Signed*) W. RUTHERFORD,
Collector of Canal Tolls.

CANAL OFFICE,
17*th November*, 1845.

No. XXIV.

No. 252.

From THE DEPUTY COLLECTOR OF CALCUTTA,

To J. MORRIS, ESQ.
Clerk to the Committee upon Municipal Improvements.

Dated Calcutta the 20*th November* 1845.

Sir,

With reference to your Letter No. 2076 and 3006, dated respectively the 18th September and 11th instant, I have the honor to forward a Statement exhibiting the Rents derived from the Surplus Lands along the Circular and Balliahghattah Canals and Tolly's Nullah, from 1232 to 1251, B. S.

2nd. The Entally and Soonderbunds Canals not being under the jurisdiction of this Office, I regret I am unable to furnish you with the Statement of Rents derived from the Lands along those Canals.

I have the honor to be,
Sir,
Your most obedient Servant,
(Signed) D. W. FRASER,
Deputy Collector.

No. XXIV *a.*

Statement of Rents derived from the Lands along the Circular and Balliah Ghatta Canals and Tolly's Nullah, from the year 1232 *to* 1251, *B. S.* [*i. e. from A. D.* 1826 *to* 1845.]

Names of Canals.	For 1232.	For 1233.	For 1234.	For 1235.	For 1236.	For 1237.	For 1238.	For 1239.	For 1240.	For 1241.
Circular Canal, ...	....	....	....	....	....	....	419 8 6	805 11 10	942 6 2	1,114 0 0
Balliah Ghatta Canal,	2,586 4 9	2,544 9 7	2,556 2 1	2,565 0 10	2,532 14 1	2,575 14 1	2,352 4 3	2,332 0 10	2,087 3 9	2,179 14 6
Tolly's Nullah, ...	10 6 4	11 8 6	11 8 6	8 10 9	11 8 6	11 8 6	8 14 11	11 8 6	8 14 11	38 5 0
Total, ...	2,596 11 1	2,556 2 1	2,567 10 7	2,573 11 7	2,544 6 7	2,587 6 7	2,780 11 8	3,149 5 2	3,038 8 10	3,332 3 6

Names of Canals.	For 1242.	For 1243.	For 1244.	For 1245.	For 1246.	For 1247.	For 1248.	For 1249.	For 1250.	For 1251.
Circular Canal, ...	1,274 2 0	1,388 5 8	....	1,762 8 0	2,350 0 0	2,350 0 0	2,350 0 0	2,350 0 0	1,834 5 0	8,342 0 11
Balliah Ghatta Canal,	1,961 11 6	2,054 13 4	2,073 8 0	2,260 11 11	2,014 5 6	1,761 10 9	2,276 6 0	2,380 0 0	2,325 9 11	2,495 4 10
Tolly's Nullah, ...	13 0 0	49 3 1	165 5 0	90 8 0	132 8 0	107 0 0	119 0 0	123 0 0	126 15 8	116 6 0
Total, ...	3,248 13 6	3,492 6 1	2,238 13 0	4,113 11 11	4,496 13 6	4,218 10 9	4,745 6 0	4,853 0 0	4,286 14 7	10,953 11 9

	Total, Co's. Rs.	Remarks.
Circular Canal, ..	27,283 0 1	
Balliah Ghatta Canal, ...	45,916 6 6	
Tolly's Nullah, .	1,175 12 2	
	74,375 2 9	

CALCUTTA,
DEPUTY COLLECTORATE,
The 20th November 1845.

E. E.
D. W. FRASER,
Deputy Collector.

Exd.

N. C. MITTRE.

No. XXV.

Queries to which Answers are requested by the Municipal Committee relative to the lines of Navigation between the Hoogly and the Ganges through the Soondurbuns, and to a Canal to Channel Creek.

1. What advantages have resulted from the formation of the Canals projected by Major Schalch from the Chitpore Bridge, and thence through the Salt Water Lake to Bamenghatta and Hoseinabad, on the Juboona River? Is the passage through these Canals generally used and preferred, to the former route through the Soondurbuns; and with what advantage in point of time, and safety, and convenience in the Navigation from Hoseinabad to Calcutta?

2. What local advantages would be obtained from continuing the above Canals as proposed by Major Schalch, and shown in Captain Prinsep's and Lieut. Hodges' Maps of the Soondurbuns from Hoseinabad to Koolna? What would be the shortening of time, and the additional safety and convenience thereby obtained in the Navigation from Koolna to Hoseinabad?

3. What is the probable number of Boats, and of what Tonnage, that now come down the Ganges, and so to Koolna, on their way to Calcutta, during the months of January, February, March, April, and May, when the communication between the Hoogly above Calcutta and the Ganges is obstructed?

4. What is the time now taken on the average by loaded Boats, during the above dry months, between Rajmahal and Calcutta by way of Koolna; and of this how much is actually taken between Rajmahal and Koolna, and how much between Koolna and Calcutta by the Soondurbuns?

5. Do Boats now frequently, or ever, take the route from Koolna to Hoseinabad, thence to take advantage of the Canal through the Salt Water Lake to Calcutta?

6. Do the dangers of the passage between Koolna and Calcutta through the Soondurbuns from Tigers; from the crossing the large Rivers; from the necessity of Anchoring with such frail Boats, and imperfect tackle as are used in this Navigation, and the delays in waiting for changes of Weather and Tides thereby occasioned, remain now the same as in 1822, when the Answers now submitted to you for your perusal were returned to a Committee then appointed to inquire into these matters? Or, in what degree, and by what causes, are these dangers and delays diminished? Do they now influence the rate of freight; and if so in what degree?

7. Supposing a Canal, such as that from Hoseinabad to the Salt Water Lake, completed from Hoseinabad to Koolna, what probable amount of Tonnage or number of Boats would take that route to Calcutta, in preference to the present; and with what saving of freight—and what part of that saving might be levied by the Government as Toll on such new Canal without inducing a preference of the old route, or overburdening this branch of the Navigation?

8. What is the amount of Trade between Calcutta and Assam, Sylhet, Dacca and Chittagong, and places adjacent, which is now carried on through the Soondurbuns to Calcutta; and which of the Soondurbun routes, as shewn in Lieutenant Hodges or Captain Prinsep's Map of the Soondurbuns, is generally used by Boats coming from those places on arriving at Magpussa and Sujagunge, on the Domuda River, at its junction with the Charcolly River, and again on arriving at Koolna; and do the Boats from the above places mostly discharge their cargoes at Balliaghatta or Tolley's Nulla, and what is their general burden?

9. Is the portion of the Commerce of the country that may now be conveyed in large Boats, likely to adapt itself to the Navigation of the new Canals in respect to using Boats of light draft?

10. Provided that a navigable Canal of 130 miles long, existed from Rajmahal, on the Ganges, to Mirzapore Creek on the Hoogly, which it is calculated would shorten the distance about 15 or 20 days to Boats coming from the Upper Provinces proceeding through it, instead of by the Soondurbun passages to Calcutta; and a Toll of 2 Rupees per 100 maunds of a boat's burden were levied on Boats passing through such Canal, or four times the amount of that levied by the Soondurbun route, and the passages by the Bhageruttee, Jellinghee, and Mattabanga were closed; are you of opinion that the Commerce of the Upper Provinces would still continue to come by the Soondurbun route in preference to the more expensive, though possibly more convenient passage by the Rajmahal Canal?

11. Are all the present Soondurbun passages kept clear of sunken wrecks and boats, and the Towing paths free from jungle and in good order; and are there any stumps of Trees and Sand-banks which obstruct the Navigation? If so, please to state in what localities these things exist. Have you any observations to make in regard to the dangers and inconveniences of the Soondurbun Navigation, and the means of improving it?

12. Do any and what description of Boats make use of the route taken by the Steam Vessels passing to and from the Hoogly at Channel Creek through the Soondurbuns, and thence into the Ganges?

13. Could Ships with any convenience or advantage proceed from Sea up Channel Creek, there to discharge their cargoes for transmission to Calcutta by Boats?

14. In the present state of the Trade, and of the Shipping resorting to the River Hoogly, and taking into consideration the use of Steam-Tugs, do you think any, and what advantage would be derived from enabling Ships to discharge their cargoes at the new Anchorage, or Diamond Harbour, for transmission from thence to Calcutta in Boats by a Canal, such as was proposed by Major Schalch independent of the Hoogly above that point?

15. If a Canal from Tolley's Nullah to Channel Creek, as proposed by Major Schalch, were carried into execution, would Commodities from Dacca, Sylhet, Assam and Chittagong, and places adjacent, and from which of them, come by it to Tolley's Nullah; and with what, if any, advantages over the present route?

No. XXVI.

Answer of ALLAN, DEFFELL, *& Co. to the Queries printed at page* 115, *of this Appendix, marked No. XXV.*

No. 2087.

J. MORRIS, ESQ.
Clerk to the Committee upon Municipal Improvements.

SIR, *Calcutta, 6th December,* 1845.

Your letter of 6th ultimo, on the subject of Canal Navigation through the Soonderbuns, has received our best attention, but we prefer incorporating any thing we may have to communicate, through the medium of the Chamber of Commerce, to whom we find you have addressed yourself on the same subject.

We return the Book of Reports and Maps.

We take this opportunity to express a hope, that the state of the Native Town of Calcutta, will come within the scope of your Committee's labours; and that the Strand Road will be carried round to the Canal at Cossipore; the Canal from the Salt Water Lake brought round *South* of Calcutta, and several deep drains cut from the Canal into the Hooghly through the Native Town, and one or two wide streets opened at right angles from the River. The state of the Native Town demands the immediate attention of the local Government.

We remain,
Sir,
Your most obedient Servants,
ALLAN, DEFFELL & CO.

No. XXVII.

Answer of J. H. HOLMES, ESQ. *Secretary S. U. I. Co. to the Queries printed at page* 115, *of this Appendix, marked No. XXV.*

To J. MORRIS, ESQ.
Clerk to the Committee upon Municipal Improvements, &c.

SIR, *Calcutta, 10th December,* 1845.

I had the honor to receive your Letter No. 2094 of 6th November 1845, requiring of me to report the present state of the Canal Navigation through the Salt Water Lakes and the upper Soondurbunds, and any suggestion I can offer in the removing of inconveniences to Boats insured at my Office passing that route.

I regret much to say, in reply, that I have not had any opportunities of moving out of Calcutta, so as to speak positively on the Queries set forth, but generally to remark, from reports frequently made by the Churranders and Manjees of such Insurance Boats, of the great inconvenience from obstruction they meet with in the passages by the Soondurbund route, of the narrow and shallow state of the passages, that I have been frequently obliged to send people to assist in lightening Boats to cross the shallows, and the only suggestion I can offer, would be to remove the difficulties in the Navigation, by *widening* and *deepening* the bed of the Rivers, in those parts, so as to admit of Boats of any size to navigate without obstruction during the *dry months.*

The Boats generally are of the burthen of 1,000 to 1,200 maunds, which come down from the interior, and from their bulk and draft of water it is impossible for them to pass without dangers.

I am sorry that my being stationary in Calcutta, and from the nature of my business, I have not had time to enquire into matters, so as to remark with any satisfaction to the proposed Queries.

The printed Book, &c. that accompanied your letter, as requested, is herewith returned.

I have the honor to be,
Sir,
Your most obedient Servant,
J. HOLMES, *S. U. I. Co.*

No. XXVIII.

Answers of D. McPherson, Esq. Soondurbun Grantee, to the Queries printed at page 115, *of this Appendix, marked No. XXV.*

To J. MORRIS, ESQ.
Clerk to the Committee upon Municipal Improvements, Calcutta.

Sir,

I have the honor to acknowledge the receipt of your Letter No. 3,001, dated the 5th November last, and in reply beg to submit a few remarks regarding the Eastern Canal, and for the Committee's consideration.

I have to apologise for having delayed so long to reply to your Letter, but my absence from Town, together with having much business to attend to at this season of the year, has been the cause of the delay.

Should the Committee desire any further information regarding the Huseinabad Canal, I shall be happy to furnish any information in my power, verbally, by attending at the Town Hall for that purpose.

I have the honor to be,
Sir,
Your most obedient Servant,
D. McPHERSON.

Calcutta,
8th January, 1846.

No. XXVIII. *a.*

The Eastern Canal from Balliagatta to Huseinabad is much frequented by Boats not drawing more than 4 or 5 feet, but Boats of a larger description are obliged to take the Southern route by the Roymungul and Attarabanka rivers, a great number of the large Boats pass through the Canal when returning empty.

The distance by the Eastern Canal is much shorter and safer than by the other line, but as the Canal has not been deepened since it was first made, except for a short distance, about 14 years ago in the Cut between Bamangatta and Cantatulah, it has become very shallow at Bhaugor, Choital, Bowaneepore and Soolkooniah, at which places Boats drawing 4 feet, can only pass through at high water.

The Canal at the places alluded, more particularly about Bhaugor, become dry, even long before low water Tide, consequently causing great detention.

To make the Canal really useful, it would be necessary to deepen all the Cuts from Bamangatta to Huseinabad. The natural Creeks and Rivers on the line are deep enough for any sized Boats—but should the proposed Canal from Huseinabad to Koolna be carried into effect, then, to avoid the Southern route, the present Canal should be made deep enough to allow Boats of the largest draught to pass through, otherwise, Boats, on arrival at Huseinabad, would have to run down the Jaboonah River—Bissuntpore and the Kalindee River, and so on by the present Southerly route to Calcutta.

The Towing paths require to be kept clear of jungle, and bunds made on low lands under the influence of the Tides, also a few Bridges* made over small Nullahs that occasionally intervene.

To keep the Canal however in good order, and to see that the Towing paths are kept in repair and free of jungle, European superintendence is absolutely necessary ; at present a few hired Coolies are sent under the charge of a Sirdar, who cut a few bushes here and there, but the work is done in such a slovenly manner that no permanent good is effected by such an outlay. The Cut from Cantatullah to Chiltaberiah, on the north bank, is overrun with Date and Babool trees to the water's edge, so that no Boat can track along that line, and the same is the case in many other places on the route.

I made an offer to the late Captain Thomson to keep the banks of the Kooltee Khall clear of jungle, as far as my own land extended, and to allow the use of my own bund for people towing Boats along the River, provided the actual expence of clearing the jungle only should be paid ; but the amount placed at Captain Thomson's disposal, was so small, that he could not allow more than one-fourth of the sum that the labour would incur.

The whole sum allowed to Captain Thomson for clearing the Towing paths, &c. from Bamangatta to Huseinabad was only 700 Rs. yearly.

There are not many sunken trees or stumps in the Eastern Canal, but I have known of several accidents to Boats from this cause, as the banks fall in occasionally, and perhaps bring down a large tree, which is not in all probability ever removed. One or two Tanks along the line would be of great use to the people passing through ; fresh water is scarce in the Sunderbuns, and travellers depend entirely on the good will of a few of the Grantees and others who have made Tanks at their own expence ; a good many labourers are to be had from the beginning of January to the end of May, but principally from the old cultivated country bordering on the Sunderbuns.

To fill up all the large Khalls that enter the different Cuts of the Canal would be impossible ; but all small Creeks may easily be blocked up. No drainage should be allowed to the Canal, unless by Sluice Gates, otherwise considerable injury is caused by openings in the soft soil, where the rush of water carries a large portion of earth into the Canal, which of course helps to fill it up ; this is particularly the case between Cantatullah and Bhaugor, where these openings have in several places grown into considerable sized Nullahs, which compel Boatmen either to wade through, or otherwise to get on board of the Boat, in order to be able to cross these annoying stoppages.

I am not aware of any improvement that can be made on the Southern route through the Sunderbuns, further than making one or two Tanks in convenient places. The want of fresh water is seriously felt, and I know of an instance in which an affray occurred between some of the Governor General's servants and the Grantees' Ryots on account of fresh water, which led to a prosecution before Mr. Mytton, then Magistrate at Baraset. Many Boats are annually wrecked, and men taken away by Tigers on this route—but I have only heard of one instance of a man having been taken away by a Tiger on the Huseinabad Canal.

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* *i. e.* Rustic, or wooden Bridges.—J. M.

With respect to that part of the Canal between the Lake and Intally, I beg to offer a few remarks.

The Circular Canal has no doubt greatly improved the old Canal from Termoony to the Toll house. When the Locks at Chitpoor are opened, the rush of water from the Hooghly is very strong, by which means the Canal has been kept clear of deposit, and also greatly widened during the last few years; large pieces of the Cutcha road on the South side has been undermined and carried away, and it is to be hoped that a few more years will suffice to sweep that road away altogether; but the great strength of the current when the Locks are opened (on account of the yet narrowness of the Channel) has been the cause of much injury to deeply laden Boats, large numbers of which are constantly to be seen sunk in the Canal; this evil would however be removed if the Canal was wide enough to admit of two of the largest sized Boats to pass out and in freely, without coming in contact with each other, which is not the case at present. The Superintendent some years ago had piles driven in to support the banks, but I am happy to see that they have nearly all disappeared; the sooner the banks give way the better for public convenience.

I would also suggest that a substantial bund should be made from the English Salt works along the Lake Canal, with Bridges on the Nullahs to Bamangatta. A small bund has been made along a part of the distance, but it has generally been overflowed during the rains, and consequently impassable. A bund of 30 feet base, and 6 feet high, is required in such low land.

I also beg to submit a few remarks regarding the Establishment employed in managing the Toll on the Canal. I have been in the habit of passing out and in almost every month during the last 15 years, and while I freely acknowledge that the Canal has been much better managed since it has been placed under the charge of a Military Officer, still I am of opinion that one or two active European inspectors is much required, to be constantly on the spot, for the purpose of controlling and checking the Native Subordinates, so as to prevent all abuse and extortion, which is, at present, to my certain knowledge, universal amongst them, for not a Boat can pass out, and in, even although it may be under the size that are required to pay any Toll whatever, without paying certain sums which the Canal Officers call Dustoor, not a pice of which sums finds its way into the Public Treasury.

With reference to a Canal from Huseinabad to Koolna, I am not sufficiently acquainted with that part of the country to offer an opinion, but judging from the appearance of the country on the map, I think it would be of great benefit,—particularly if it were made deep enough to admit Boats drawing 7 or 8 feet—it would certainly improve that part of the country very much, and drain the large waste called the Boirah Jheel, as well as affording a safer and shorter passage from the upper provinces.

I am of opinion that a Canal from Tolly's Nullah to Channel Creek would be of great benefit, and easily executed. The traffic from the country South of Calcutta, is very large, particularly in the article of Rice, immense quantities of which is brought to Town for shipment to Europe; besides a large quantity of salt from Tumlook, Hidgelee, and Diamond Harbour would pass through that line; at present all the Salt and other produce can only go during the North-East Monsoon by Channel Creek and the Dooagrah River, through the Soonderbuns, a dangerous and circuitous route, which occupies 7 or 8 days in passing through an entire waste where Tigers abound, and not a drop of fresh water obtainable. The distance from which firewood is brought into Calcutta at present is upwards of one hundred miles—indeed, a large portion of that necessary article is brought from Bakergunge, while, should a Canal be opened to Channel Creek, an immense quantity of fuel would be available within a short distance of the capital. The Canal from Tolly's Nullah to Channel Creek would have no cross currents the whole way, and with a Lock on the Diamond Harbour Creek, and perhaps one at Culpee for the entrance of Boats from the

Hooghly, there would only be the Tide from Tolly's Nullah and the other from Channel Creek, which would prevent the frequent deposit that occurs in the Eastern Canal, a few Sluice Gates to drain the country would be required. Such a Canal would, in my humble opinion, soon repay the outlay to Government. I saw a few days ago when at Saugor, a large fleet of Boats loaded with salt, passing through Channel Creek from Hidgelee en route to the eastern provinces, which they can only do at this season of the year—whereas a Canal on the line alluded to, would afford a safe and quick passage at all seasons.

7½ Chowringhie,
8th January, 1846.

D. McPHERSON,
Soondurbun Grantee.

No. XXIX.

Answer of J. Carey, Esq. to the Queries printed at page 115 of this Appendix, marked No. XXV.

To J. MORRIS, ESQ.
Clerk to the Committee upon Municipal Improvements.

Sir,

I beg to acknowledge the receipt of your Letter, No. 3021, dated 11th December last, and in answer to state, that I should have replied without delay to the same, had not severe ill health then prevented me. Being somewhat recovered now, I take the liberty to do so to the best of my knowledge and ability. The documents that accompanied your letter I returned to your Office at the time, and now return the only one I then retained. With the exception of my regular trips weekly through the Ballyaghat Canal to Narainpore, I am sorry I can give no information regarding any other part, not having had occasion to visit them. It is now about 9 years since I was appointed to Narainpore, and I am happy to state, that the passage from Ballyaghat to Narainpore has been very much improved during that period. There are still near Ballyaghat, sunken Boats and Fishermen's Stakes in parts of the Canal, which ought to be removed, but nothing equal to what there used to be in former times—and in my opinion, if the Canal could be kept free from these, made wide enough at Ballyaghat to receive the number of Boats that come in at certain times of the year, when it is so full that the passage is nearly choked, and embankments or bunds made on both sides, with the jungle cut away for tracking boats, the passage up to, and through, the Ballyaghat Canal might be made as safe and desirable as possible.

I have the honor to be,
Sir,
Your most obedient humble servant,
J. CAREY,
Superintendent Narainpore Salt Works.

Calcutta,
9th January, 1846.

No. XXX.

Answer of ALFRED HARRIS, ESQ. *to the Queries printed at page* 115 *of this Appendix, marked No. XXV.*

J. MORRIS, ESQ.
Clerk to the Municipal Committee.

SIR,

I beg to acknowledge your communication of the 11th ultimo. My absence from Calcutta has delayed my answering it earlier, and at the same time I am sorry that I am unable to give more information.

Q. 1. The advantages of the Chitpore Canal has been great, which is clearly shewn by the immense traffic that daily passes through it, as well as that of the Salt Water Lake. Both these Canals are subject to much improvement. 1st, By better attention being paid to keeping the Channels clear of wrecks and other obstacles that are daily occurring. I have known sunken Boats to remain for days together without the least effort being made to clear the obstruction; Fishing Boats, mooring their nets in the passage of the Lakes, much impeding the passage through that Channel, which ought not to be permitted; the Chur that has formed at the Balliaghatta end of the Lake Canal ought once every year to be cleared away, as the Boats cannot get out of the Canal after the tide has ebbed; the careless manner in which all the Boats are laid, in all parts of the Canals, both loaded and unloaded, stopping up both inward and outward transits; this occurs from the insufficiency of the Native superintendence, whereas if one or two European overlookers were placed on these very thronged Canals, would tend much to facilitate the Navigation, and be the means of protecting the inward produce that passes through.

The Canal from the Canal Toll Gate to Bamenghatta requires a Tow Path, one has been attempted, but of so small a description as to be of very little service on spring tides; also a number of the smaller Nullahs have no* Bridges for people to pass, except by swimming.

The part of the Canals that run from Bamenghatta to Chultabarriah is in the dry season almost impassable for Boats above 500 maunds, except on spring tides, when Boats of 1,000 maunds may be got through with difficulty. The length from Chultabarriah past Banghahaut to Kamergatchy, is in so bad a state that small fishing Boats cannot pass till half tide, and all the Towing Paths are out of repair, and in some places impassable from breakages and bush.

The Canal from Bussora to Hosienabad I am unable to speak from want of experience, as I have never travelled through that part of the country.

The passages by these Canals cannot be used by Boats above 800 maunds, except in very high tides, and even then not more than three in ten pass that way, but more generally by the Attra Banka route. There are many circumstances that deter Native Boats taking the Canal routes, one of which, and the principal, is the exaction that they are liable to by the different Chokeys and Thanas on the passage, which daily can be observed in the Balliaghatta Canal; therefore if it takes place so near the city, what must it be in more distant parts, where detection is so difficult—the poor people rather than be detained will pay any demand so as to pass on. I merely advert to this, as one of the reasons that tends to prevent these Navigations being used; these exactions being added to any Toll the Government may wish to impose, will almost prevent Boats taking these passages.

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* *i. e.* Rustic or Wooden Bridges. —J. M.

The traffic by the Soonderbuns via the Attra Banka passage from Culna, Chittagong, Burmah, Shylet, Dacca, and all the Eastern Provinces is immense in the Dry Season, it is one continual transit of Boats, of sizes varying from 100 to 6000 maunds, carrying all descriptions of produce. I should say 30 to 40 Boats are the average daily from October to April. The greatest difficulty felt on this passage is the want of fresh water, there being none procurable between Shereghatta and Attra Banka, of which place I am the owner. In the Dry Season I am obligated to forbid the Public the use of the water in my tanks, much against my will, for if I gave promiscuous permission to all Boats, my own Tenants would be left without any supply. This circumstance leads to many quarrels and disturbances; last year I laid out 500 Rupees in making a Tank, but find that is quite insufficient for the public supply. In the year 1833, I addressed the Joint-Magistrate of the district upon the matter of being allowed some assistance from the Government to enable me to excavate a Tank sufficiently capacious to supply the Public, offering a space of land for that purpose; but I obtained no reply. I am still so inclined should the Government feel disposed to assist the Public in procuring a supply of so needful an article; I would undertake to have one or two Tanks excavated on my property for the use of the Public for about 1,000 Rupees. The time saved by traversing the two routes, I am unable to give any opinion.

Q. 2. I am unable to give any opinion.

Q. 3. Ditto.

Q. 4. Ditto.

Q. 5. Ditto.

Q. 6. I should think the same dangers exist as in 1822, excepting that there is a resting place in the jungle passage, which was not in existence in that year, where boats are free from tigers, and can remain with safety in bad weather, or till tides suit for them to proceed. I cannot say if the dangers influence freight, but should suppose so in a partial degree.

Q. 7. Native boats, " where time is not an object," would I think in the fine season, rather prefer the Soonderbun passage than through the Canals, from the circumstances I have already alluded to.

Q. 8. I cannot give any opinion upon the amount of trade from the places mentioned, but I know it is of very great extent, if I may judge from the number of boats passing through the Attra Banka, the greater part of which boats discharge their cargoes at the Balliaghatta, or pass through that Canal into the river Hoogly. I should say eight out of every ten boats, pass the Balliaghatta in preference to Tolly's Nullah, as part of the latter passage is obstructed by shoal water.

Q. 9. Unable to give any opinion.

Q. 10. Ditto.

Q. 11. I mentioned before, [that] the Canals, in many places from Balliaghatta to Kamergatchy, are often obstructed for days together by sunken boats, and all the tow-paths are in want of repair—bridges over Nullahs, and jungle on the banks, all obstruct the navigation, which with very little cost, and better superintendence, would be done away with. The Balliaghatta is generally the most obstructed; this occurs by the inattention to the laying of the boats loading and unloading, and the dilatory exertions that are made to clear away any sunken boats. I have seen them laying for days after the accident may have taken place, much to the detriment of the navigation. I have never seen any very great danger in the Soonderbun route, although it must exist, with such frail boats as sometimes take the passage; but from September to April very little, and when any loss does occur, it generally is from negligence or the incapacity of the people in the boats, and their overloaded state. Water is the principal detriment on this passage.

Q. 12. I have been in the habit of traversing up and down the River Hoogly all the year round for upwards of twenty years, and I have barely ever seen any Boats pass in or out of Channel Creek, excepting those belonging to the people on Saugor Island. A few Salt Merchants' Boats from Diamond Harbour may occasionally do so, but I do not think any others.

Q. 13. In my opinion Ships in the S. W. Monsoon would not be able to use Channel Creek as a place of safety to discharge their Cargoes. In the 1st place in some parts it is barely navigable; 2nd, there is no water or provisions procurable; and in the 3rd, no Ship would lay there to discharge, when, for half the expence and risk [they] could, by taking steam, go up to Calcutta, where every convenience is to be procured, to refit, repair, reprovision, unloading and reloading, which in my opinion would be done cheaper and with greater expedition; and first of all to be considered, is the health of the Crews, who would invariably suffer in such an unhealthy spot. Where the Canal is proposed to terminate in Channel Creek there is no place in its vicinity for Ships to anchor. I do not think that Ships would find any advantage in discharging their Cargoes in Channel Creek.

Q. 14. In the present state of the trade to Calcutta, I do not think any Ships would discharge their Cargoes at Saugor " there being no New Anchorage;" or do I think at Diamond Harbour, except in casual cases of injury and damage, as Ships can be taken to Calcutta in less time than their Cargoes would take to reach by the Canal. It would be only isolated cases of Ships being too deep to cross the James and Mary's, when that Channel may be in a bad state; even in this case it would be only a few boat-loads that would be discharged to lighten a Ship a foot or two. There are a great many circumstances operating against Ships loading and unloading at Diamond Harbour, the constant want of quick communication between the parties interested in loading and unloading; great risk of damage to Cargoes passing up and down even in a Canal, more so in the rainy months. After all, it could not be done cheaper than if the ship discharged at Calcutta, where every convenience is to be procured for immediate dispatch. No Boats can be used in the S. W. Monsoon to unload Ships at Saugor—therefore Sloops must be used, which would not be able to pass through a Canal. Boats from the Western side of the Bay and River, such as Cuttack, Balasore, Hidgellee, would never cross the River to enter the Canal at Channel Creek or Diamond Harbour. To the first named place the heavy Sea that generally runs between Kedgeree and Mud Point, would deter them from attempting to cross; the Western Shore being generally a weather one, they run up along it to Diamond Harbour; when once arrived there, they are in comparative safety, and would not feel disposed to pay for entering the Canal; money being the main object with natives and time nothing, they will always sacrifice the latter to the former, which ought to be considered with regard to an undertaking paying itself for the outlay.

The Steam hire for taking Ships up and down the Hoogly is greatly on the decrease, and will be still more so in a few months, as more opposition is brought into play; therefore it is reasonable to suppose that Ships would proceed to Calcutta to discharge in preference to remaining below it, to much inconvenience, and the expense of proceeding to Calcutta being so moderate, the city being the head mart of all commodities, and heart of all interests, would tend always to induce Shipping to proceed to it.

If the Government are disposed to facilitate the Navigation of the River Hoogly, a Canal being formed between Fultah and Diamond Harbour sufficiently deep to take a Ship of 18 feet through on a Flood Tide, would in my opinion do more to benefit the navigation up the Hoogly, and the interests of the port of Calcutta, than any Canal that could be formed to Channel Creek or Diamond Harbour. Ships would use it in preference to risking passing over the dangerous Shoals at the James and Mary's and Fultah Sands; the expence would be less, Commerce would be expedited "and time saved." The distance is but small, being only 5 to 6 miles, and two good entrances can be procured for the entrance and discharge of the Ships, one being at Fultah Creek, and the other a little below Krockrahatta trees. This passage would be the means of avoiding a number of very dangerous shoals, and sometimes facilitate Ships arriving in Calcutta from one to four days, which would be a great object alone, besides avoiding those dangers already mentioned.

Q. 15. Providing a Canal, formed between Tolly's Nullah to Diamond Harbour or Channel Creek, as proposed by Major Schalch, was carried into execution, I am of opinion that commodities from Dacca, Sylhet, Assam, Chittagong, and other Eastern parts, would not proceed by it, for these reasons—it is the interest of boats to keep as much as possible under the protection of the land, [they] therefore, would not risk crossing the mouths of so many large rivers as would lay in this passage, liable to more stormy weather and heavier sea, than in the more Northern route through the Soonderbuns, via the Attra Banka; again, the want of fresh water would be a very great obstacle—the want of which would be more felt than in the other route; and less capability of being able to supply the wants of the public, there being so much forest land in the journey, and, I should say, greater risks of the people being taken by tigers; in fact, I cannot observe any benefit to the navigation over the present routes, by a Canal from Calcutta to Diamond Harbour or Channel Creek; the only advantage it could possibly be, would be to benefit the line of country immediately in the vicinity of which it passed.

I have the honor to be,
Sir,
Your most obedient servant,
ALFRED HARRIS.

CALCUTTA,
13*th January*, 1846.

No. XXXI.

Answer of JAMES MACKENZIE *Esq., Soondurbun Grantee, to the Queries printed at page* 115 *of this Appendix, marked No. XXV.*

To J. MORRIS, ESQ.
Clerk to the Committee upon Municipal Improvements, &c. &c. &c.

SIR,

I beg to acknowledge the receipt, this day, of your letter dated the 6th instant, and regret that the Papers, to which it alludes, were not returned when sent to my house in November last, as I was then in England, and only came back to Calcutta by the Steamer Bentinck, last week.

Having been prevented by indisposition, from visiting the Soonderbuns during the last seven years, I can only appeal to my recollections of what occurred on the subject under reference, prior to that period. After the Canals from Chitpore Bridge to Hoseinabad were completed, I frequently passed through them in a small Boleah, endeavouring thereby, to obtain a saving of time; yet, at last, I resumed the old passage through the Attara Banka as preferable. Once I passed through in my Pinnace, but found the new Cut to be less safe, and more inconvenient for a vessel of her size, than the old route.

I have no knowledge of the Soonderbun route beyond Hoseinabad and Bissunpore,—of the number of Boats using it during the dry season,—of the time taken up in their passage,—or of the amount of trade carried on by their means.

When the Canal from Rajmahal to Culna was first projected, I considered that it would have been of great advantage to the internal trade of the country, but when this trade *must* soon be so much influenced by Steamers, and *may* at no distant time, be so greatly facilitated by railroads, the propriety of *now* making a Canal, subject to the risks noted in Schalch's Memoir, and liable to be superseded by preferable means of conveyance, may be questionable.

When, also, Schalch's Canal to Channel Creek was projected, its speedy completion might have secured advantages to the mercantile community, that they would have then considered valuable; but the facility since afforded by Steam Tugs to the navigation of the River, has taken away all occasion for the construction of Canals or railroads below Calcutta, since they could afford no benefits sufficient to counterbalance the waste of human life, that would attend both their original formation and subsequent employment.

I have the pleasure to return, herewith, Appendix (G) with its Appendix, and the separate Map of the proposed Canal to Saugor, and am,

Sir,
Your most obedient servant,
JAMES MACKENZIE.

SULKEA,
11*th February*, 1846.

No. XXXII.

Answer of H. LIMOND ESQ., Secretary to the Bengal Chamber of Commerce, to the Queries printed at page 115 *of this Appendix, marked No. XXV.*

To J. MORRIS, ESQ.
Clerk to the Municipal Committee.

SIR,

Referring to your communications demanding information from the Chamber of Commerce,—in regard to the Canal Navigation through the Salt Water Lake and the Upper Sunderbunds,—and in regard to a proposed Canal to Saugor,—and to the subject of any of the queries in the printed Paper which you furnished—I have to express generally, as the belief of the Chamber, that the works already executed by Government, to maintain a line of communication between the Hoogly and the Ganges through the Upper Sunderbunds, have been of great service to the Trade of the Country; and every improvement of that line must be productive of additional benefit. The Chamber does not possess the means of computing the extent of Commerce which seeks that Channel.

2. The Chamber is not impressed with a high opinion of the advantages which would attend the formation of a Canal from Tulley's [Tolley's] Nullah to Channel Creek. The shipping bearing the maritime trade of this port, would not, it is persuaded, unload or load at Diamond Harbour, but find its way up to Calcutta; for which the increasing provision of Steam Tugs affords facility and security. The construction off Town of suitable wharfs, is the desideratum of most importance, which the Chamber would recommend the Municipal Committee to urge on the favourable consideration of the authorities.

3. The Chamber feels assured, that Government could not undertake a work of more utility to the Trade of the interior, than would be achieved by opening a direct communication between the Ganges and Hoogly, navigable throughout the year, such as would prove the projected Canal from Rajmahal to the Mirzapore Creek. This Canal would command the resort of a vast traffic. It might even, on that line and to that extent, be more desirable than a railway.

I have the honor to be,
Sir,
Your most obedient servant,
H. LIMOND, *Secretary.*

CALCUTTA,
BENGAL CHAMBER OF COMMERCE,
April 4th, 1846.

No. XXXIII.

Answers of **James F. Hedger** *Esq., to the Queries printed at page* 115 *of this Appendix, marked No. XXV.*

To J. MORRIS, ESQ.

Calcutta.

Dear Sir,

Mr. Rainy being so much engaged, and so continually absent from home, he has been unable to reply to the questions sent by the Municipal Committee, regarding the Navigation of the Soonderbuns. As far as my knowledge extends, I have given replies, which I hope may be of use.

I am, Dear Sir,

Yours faithfully,

JAMES F. HEDGER.

Kholna,

April 13*th,* 1846.

No. XXXIII. *a.*

Q. 1. Very great advantages have resulted, and the Canals are universally used; being shorter and safer routes to Calcutta.

Q. 2. Cannot say what advantages would be obtained, as boats are entirely dependent on the tides in the Soonderbuns; of course, if a good towing path was made, then a Canal from Hosenabad to Kholna would be highly beneficial.

Q. 3. Impossible to say. Immense in number and tonnage.

Q. 4. Cannot say the time between Rajmahal and Kholna. From Kholna to Calcutta, the largest sized boats, six to seven days, if not delayed in the Chitpore Canal, as is usually the case, to the great detriment of many valuable and easily perishable cargoes: small boats can reach Calcutta, in as short a time as two days and a half.

Q. 5. Always, I believe.

Q. 6. Very little danger from tigers: of course danger to the large unwieldy native boats in the larger rivers during storms. The greatest danger, however, is from Dacoits, and other bad characters. The writer of this, has seen a boat cleared out at *three o'clock in the day;* and has also been a witness to the people of some Zemindar, or Talookdar, taking toll from every boat, that had to pass through a narrow Channel at low water. Many unfortunate people came to the writer for protection. Robberies of one description and another, take place every year, to the extent of many Lacks of rupees, if native reports are to be believed; there appears to be no police in the Soonderbuns. No doubt, if there was proper protection, the trade would be much greater by this route to Calcutta. Boats with valuable cargoes seldom go singly, but in fleets, on account of Dacoits. It is a well known fact, also, that native people in charge of valuable cargoes are watched into and about Calcutta, and then again into the Soonderbuns; and the proceeds of their goods taken from them there. In short, robberies are of hourly occurrence, and will be so, till there is a Magistrate and two or three European Daroghas appointed to the charge of the Soonderbuns; and these officials might much assist in clearing away numerous wrecks and stumps of trees, &c., &c.

Q. 7. Am unable to give a satisfactory answer.

Q. 8. The boats are generally of large Tonnage, but cannot say what,—or give any reply to the other part of the query.

Q. 9. Certainly not, till the boats in present use are done for, as natives are not extravagant in the boat-building line; and many have not the means, although the inclination.

Q. 10. No doubt boats from the Upper Provinces would take advantage of the Canal proposed, were it wide and deep enough for them, and there was a good towing path; the chances are, however, the Canal would soon be filled up with Ganges sand; there is no sand in the Soonderbuns.

Q. 11. All the narrow Rivers are full of wrecks, stumps of trees, &c., as any one can see at low water, and there is very little towing path, and what there is, is much obstructed by jungle. The Chitpore Canal is also famous for wrecks, which lay there for weeks; and the piles driven in at the sides of the banks, are very dangerous, as all the mud is washed away from them, and a boat at high water, when they are not visible, anchoring over them, is liable at low water to have her bottom stoved in. All who have been to and from Calcutta via the Soonderbuns, are unanimous in their opinion of the negligent manner in which the Darogah and others of the Chitpore Canal perform their duties. It sometimes takes eight or ten hours for a small Bauleah to go through the Canal, on account of the many boats of all sizes, allowed to anchor there.

Q. 12. Can give no satisfactory answer.

Q. 13. Cannot say.

Q. 14. Calcutta Merchants can give the most satisfactory answer to this.

Q. 15. Generally speaking, Boats with cargo are consigned to European or Native Merchants' houses in Calcutta, and would of course go to the most convenient and nearest spot to discharge.

J. F. H.

No. XXXIV.

Answers of A. Warde Esq., Superintendent of Salt Chowkees in the Soondurbuns, to the Queries printed at page 115 *of this Appendix, marked No. XXV.*

A. 1. Increased facility of bringing the Produce of the Country through which the Canals pass; greater safety and convenience to the passage of Boats coming from the Upper and Eastern Provinces and districts adjacent to the Canals; and I have not the least hesitation in stating it as my opinion, founded upon observation and experience, in my constant passages through the various Soondurbun Creeks and Rivers, that no Boat that could effect a passage through the Upper Soondurbuns or Canal Route, would ever follow that of the Lower or Attarabanka route, for the following reasons,—

Boats proceeding by the Lower Route are much subject to being wrecked in blowing weather, especially on passing the mouths of the numerous large and deep Rivers which open into the Attarabanka passage or Lower Route, where there is generally a dangerous swell and gusts of wind, which, acting on the round bottom country Boats laden to the very water's-edge, sets them rocking and rolling, by which they take in water and become water-logged, and ultimately sink, and the crew plunged into a deep and rapid river, where alligators of the largest size abound, and if the crew succeed in getting safe to the shore, they are still exposed to be devoured by tigers, as the greater part of the Lower Route is through a very dreary waste or Jungle, with not a habitation near, or even fresh water procurable. The case is widely different in the Upper Soondurbuns or Canal passage, where Boats, not being within the influence of the openings or wide mouths of numerous large rivers, are not subject to sudden gusts or heavy swells; and in case of their being wrecked by any accident, their cargoes are not all lost, as the Boats are not in deep water:—again, there is not such fear of wild beasts, as the greater part of the route is *now* through *cultivated* land, where fresh water and supplies from bazars are procurable as well as assistance. The time taken up by heavy Boats in both passages, is about the same; but Boats of light draft effect the passage in less time by the upper than by the lower route. I have heard of Bauleahs effecting the passage from Hoseinabad to Calcutta in 17 to 24 hours. I have heard Indigo Planters and others say, who have very large pinnaces *well* found in tackle and stores, and every convenience on board, that they prefer the lower route, as not being exposed to obstructions, and from the inconvenience of stopping at low water between the high wet banks of the Canals.

A. 2.—Increased cultivation; great advantage to the inhabitants residing in the neighbourhood of the proposed Canals, in respect to the convenience of conveying their produce to distant markets; draining and irrigating large tracts of land; greater safety, by the avoiding of large Rivers, especially at those points where several Rivers meet; and I think a shortening of time in the passage would occur, by the avoiding of some very considerable bends of Rivers.

A. 3.—I cannot answer this question. Returns from the Superintendent of Canals, *should* give this information.

A. 4.—Ditto.

A. 5.—Much the greater number of Boats pass by the Canal route, thence through the Lake Channel to Balliaghat and Calcutta.

A. 6.—The dangers and inconveniences of the Attarabanka passage, remain the same as in 1823, except that there are now one or two patches of Land cultivated.

A. 7.—I do not think any material saving in freight would result; but I think a higher rate of Toll, would not be objected to, if some further useful Canals or Cuts, to be used chiefly as Docks, were made, and *kept*, together with those now existing, in an *efficient* state.

A. 8.—I do not know what is the amount of the Trade, but I should say, that nearly *all* the Trade which arrives at Balliaghatta and Pauspota on Tolley's Nullah, comes from the places cited, and from the countries adjacent to the Canal: but *Returns* from the Superintendent of Canals *ought* to show this, and *also* from *where* Boats come, and their *burthen* and the *description* of their cargoes:—in fact, for useful *Statistical* purposes, every Boat should be required to furnish a Document like a ship's manifest, in Bengalee or English, prepared at, or before its arrival at the Toll House.

A. 9.—Yes,—but, except some Boats from the Upper Provinces, and the larger description of Wood, Lime, and Rice boats, I do not think there are many Boats that use the Soondurbun navigation, which exceed 350 to 600 Mds. burthen.

A. 10.—Provided that the estimated saving of 15 or 20 days of time could be effected, I am of opinion, that all Boats from the Upper Provinces *north* of Rajmahl, and possibly a little *south* of it, would avail themselves of the proposed Rajmahl Canal—but I question if the Soondurbun Navigation was put on a *respectable* footing and viewed as a *National* work of *great importance* to the *increasing* trade from the *Eastward*, whether any *great* saving in time would result, by Boats passing through the Rajmahl Canal, which being obstructed by several Locks, would not be subject to the influence of tides, and consequently a passage through it, would be tedious and laborious, and at the same time would not, I understand, be available in the dry season for Boats drawing more than five or six feet water:—further, this is certain, the Rajmahl Canal would be of no manner of use to the Trade from the *Eastward*,—whilst the Soondurbun Navigation is useful *not only* to the *Eastern* Trade, but *also* to that of the *Upper* Provinces; again no Railway to the Eastward, owing to the country being intersected by numerous rivers, and periodically inundated, is likely ever to be formed—but a railway to Rajmahl, it is possible, can, and will be made—Rajmahl would possibly then become the great Receiving Depôt of all the chief staples of the *Upper* Provinces, and purchases for Shipment, would be mostly made *there* instead of in Calcutta.

A. 11.—From Baminghatta to Bangur, the Towing paths are good, but the Canal throughout requires deepening; from thence to Bhowanipoor, dense jungle on both sides, but assistance procurable if required from the various Grants. A very dangerous cut exists from Bhowanipoor to Hoseinabad, which becomes *dry* at half ebb, and so *rapidly*, that if a boat of burthen strikes, she generally *opens* out and becomes a *wreck*, from the hard nature of the soil. I have known 30 to 40 boats waiting at both ends for the tide; but the greatest danger which exists, lies between the Dappa Toll and the Teenmoony i. e. where the Circular Canal opens into the Balliaghatta Canal—Boats, which have come hundreds of miles, have escaped all the dangers of the road, rejoicing at the termination (as they hope) of their labours, find themselves suddenly deprived of all their hard earnings, by the *disgracefully* crowded and shallow state of the Nullah. In January and February last, I have often counted nine boats *sunk* in the course of a day and night. On the 23d March at night, three large lime boats were wrecked, and many more were landing their cargo on the road from want of water; and on enquiry of the various merchants, I learnt, that from 1st December to the end of March, *not less than* 150 *boats* of various kinds have been *sunk*, within this short distance, conveying property estimated at 50,000 Rupees. This Canal ought to be a passage *only* from the Soondurbuns to the Hooghly, and not an *Import* depôt, for which *separate* Cuts or Docks should be made; one of the means of forming which, would be by continuing and improving the present Cut on the Western border of the Salt Water Lake, which Cut passes to the North of the Balliaghatta Toll House and Chingreehatta. This Cut should be continued towards the Dum-Dum Road, opposite to, or near, where it turns or bends to the North, going to Dum-Dum, and thence the Canal continued parallel with the Dum-Dum Road, and within a few hundred yards of it to the Circular Canal, joining that Canal between the Dum-Dum, and Nundun Baug Bridges.—The above with another straight Cut between the Manicktollah, and the Narcoldangah Bridges, to the proposed Cut at the North Western border of the Salt Water Lake, would very likely answer all the purposes of Docks or Basins, and afford greater facilities of communication with the Salt Water Lake Channel. The above two, direct East and West Cuts, it will be perceived enter the Circular Canal opposite to the Roads leading to the most crowded parts of the Native Town. If to the above, the Balliaghatta and other Roads leading from Calcutta, to the Western border of the Salt Water Lake, were laid with tram-ways, and Storehouses erected in systematic order at the sides of those Roads, it would be very desirable, (See annexed, the plan of the Docks or Cuts which have been drawn on Captain Prinsep's map of the Calcutta Suburbs.) But another and possibly more convenient and compact, and less expensive plan has been suggested to me, and which is also drawn on the above map, and may thus be described.

A to B, represents a Cut or Dock (communicating at *A,* with the Salt Water Lake, and at *B,* with the Circular Canal) of 150 feet in width at top, and 50 feet at bottom, with a depth of about 8 or 10 feet below low-water mark, to be made parallel with the present Balliaghatta Canal, and about 500 feet from its North Bank, and with a Roadway of 25 feet wide on each Bank of the proposed Cut. The oblong excavations running from the South Bank of the above new Cut to the Bank of the Balliaghatta Canal, represent additional Docks or Basins, should they be required, which communicate by Sluices under the Balliaghatta Canal's North side Roadway, with the Balliaghatta Canal, which, assisted occasionally by the Circular Canal, is to act (there being a flood-gate in the new cut at *B.*) as scour's to clear the above Basins or Docks from deposit. The spaces of ground *between* the Docks, together with the ground on their *opposite* or North Bank, should be intersected by Roads not less than 25 feet in width, and about 80 feet apart, and formed North and South, and East and West from the Balliaghatta Road to the Bank of the Balliaghatta Canal. The sides of the above roads serving as frontages of Golahs or Storehouses, Shops or Huts, to be erected agreeably with a plan to be laid down for their construction so as to prevent crowding, and to admit a free circulation of air. It is submitted that if the above Docks were made, and the Section of the Circular Canal, between the Dum-Dum and Nundun Bagh Bridges, and between the Manicktollah and Narcoldangah Bridges, were widened, and oblong Docks or Basins, with Cranes, Wharfs and Storehouses attached, formed in the vicinity of the above named localities *between* the Circular Road and Circular Canal, *parallel* with the main Roads leading to the suspension Bridges, and within 40 or 50 feet of the above Roads, and the Docks were scoured out by the Circular Canal into the town drains, leading to the River or into a main *central* Tunnel passing through the Town and leading into the Salt Water Lake, as has been proposed, I see, by Colonel Forbes, and Boats were *compelled* to discharge their cargoes in the Docks, a free and unobstructed Channel would always be available for the passage of boats from the Lake to the River, and from the River to the Lake.

A. 12.—Very few except salt and large wood boats, I hear, ever use the route in question ; and I have heard from an old branch pilot, that he has seen nine boats of the latter description *lost* in one day, immediately on their *emerging* from the Soondurbuns into the River Hooghly ; the Canal to Saugor would obviate such losses.

A. 13.—At certain periods of the year, I think, ships could with advantage discharge their cargoes at Channel Creek or Diamond Harbour.

A. 14.—I do not consider the proposed Canal to Channel Creek as materially desirable to the Shipping, except in affording them several *contingent* advantages during unfavourable periods of the year ; but the Canal would be *importantly* useful in bringing to Calcutta the extensive Produce of the country to the South of Calcutta, and afford to all the native Boats proceeding up and down the river, a safe passage at *all* periods of the year.

A. 15.—I think commodities from Chittagong and along that coast, and from Balasore, and places on the West side of the lower parts of the Hoogly would come by the proposed Canal, but not from Dacca, Sylhet, and Assam.

All that appears to be wanting to put the Canal Navigation from the Eastward *i. e.* from the Ishamutty River to Calcutta (beyond which my knowledge does not extend,) in the most efficient state, is to occasionally deepen the present artificial cuts or Canals, and to make to the North of them and of the ridge of the Chalkoonee sand, and out of the influence of the strong tides and deep Channels of the Soondurbuns, a new cut of about 4 or 5 miles long, *i. e.* from near the Northern end of the Chandpore Khal to opposite the Tantwa Khal near Chytal, (See Sketch of the Soondurbun Canals at foot of Captain Prinsep's Map of the Suburbs of Calcutta,) where a flood-gate *possibly* would be required to prevent the tides from the Tantwa and Teoree Khals, from entering the new Cut, where they would possibly be met by an opposing tide in the Cut—the few small Nullahs that might be found leading into the new Cut from the South, should be substantially bunded. To widen the Balliaghatta Canal about 20 feet, and deepen it 3 feet in some parts. To widen the whole length of the Intally Canal, to the same section as its Western end, which would form a very convenient Basin. The above Canals are *much too narrow* for the traffic in them, which will readily be allowed, when I state that I have seen the Canals from the Lake end to the Chitpore Locks, compeletely blocked up with Boats ; and it has *often* been a matter of *surprise* to me, *how* the Boats, thus jammed up, *contrived* to make their way *into* and *out* of the Canal—but this I hear they do not effect under 2 to 7 days, and a great number of them become wrecks. To erect on the Canal banks a few public *Wharfs* and *Cranes* at which Boats might unload, on paying a small charge for the accommodation ; this would save much wear and tear to the Canal banks, especially if at the same time Boatmen were prevented driving their *luggowing* posts into the

Canal banks—there however would be no occasion for the above recommendation if Boats were *made* to discharge their cargoes in Docks.

To prevent the excavation of earth, for making bricks, and forming tanks, immediately close to the Canal banks, as the water contained in such excavations must tend to undermine the banks. To prevent, by sloping the roads at the sides of the Balliaghatta Canal towards a side Drain, away from the Canal Banks, the rain water which falls on the roads and adjoining lands, from *Guttering* the Canal Banks: a bad instance of this may be seen on one of the banks of Tolley's Nullah, at the late Coal Depôt of Messrs. Carr Tagore and Co. close to Hasting's Bridge. To make a good Road on the South bank of the Entally and Balliaghatta Canal. To make a scour for the Entally Canal, by deepening and widening the side drains of the Dhurumtollah road, which should be permitted to communicate *freely* with the *River* at the *West*, and with the *head* of the Entally Canal at the *East*; this would remove the *horribly unhealthy, and putrid back-water of the Entally Canal,* whilst the scour would tend to deepen the Canal, and save the frequent cost of excavating the Cess-pool and the Canal.

To continue* the present Circular Canal round the Town, to the vicinity of Kallee Ghat, or between that place and the Allypore Bridge, at the same distance from the Circular Road as the present Circular Canal, this would tend materially to drain the swampy ground of Curriah, and Cossiah Baugaun, and Bhowanipore.

To make another direct, *East* to *West* cut from *near* the *centre* of the Lake Channel, and thence to communicate with the proposed continuation of the Circular Canal at that part of it, which would pass a little to the East of La Martiniere School.

1*st May*, 1846. A. WARDE.

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* Note.—At the same time it might be advisable, when the continuation of the Circular Canal to Tolley's Nullah had been executed, to extend the limits of the town to the Canal bank; and to plant a double row of trees on each bank of the Canal, to check or intercept, the pernicious air coming from the Salt Water Lake and its neighbourhood; and to plant a like belt, or row of trees, near the margin of the Lake.

No. XXXV.

Answer of S. G. T. Heatly, Esq. Soondurbun Grantee, to the Queries printed at page 115 *of this Appendix, marked No. XXV.*

To J. MORRIS, ESQ.
Clerk to the Municipal Committee, &c. &c.

Sir,

I have to apologise for not having long before, at least acknowledged the receipt of your communication dated 6th November last, and I trust that the Municipal Committee will attribute the delay, which has occurred in forwarding answers to the queries addressed to me, not to any want of respect or any indifference on my part, but simply to want of the merest leisure for putting together the required information in that digested shape, in which alone it can be available for the Committee's objects.

2. The queries with which I have been honoured, relate exclusively to the present state of, and suggested improvements in, the various lines of water communication to Calcutta, put with a view to advise such measures to the Government as shall facilitate that communication to the utmost; thereby enlarging the markets for produce and ex-

tending trade. The Lines, regarding which information is more especially desired, are:—1st—That which may be termed the Lower Hooghly system: 2nd—That which may be similarly termed the Upper Hooghly system: and 3rd—The Eastern or Soonderbun system, communicating with the Eastern Provinces from Rungpore, Sylhet, &c., down to Chittagong. And as I understand the papers before me, the requisitions of the Committee divide themselves into:—1st—Full particulars regarding the present state of these several routes: 2nd—Their existing advantages and disadvantages: and 3rd—Opinions and suggestions as to their amelioration.

I. Lower Hooghly Navigable System.

3. The Queries [Nos. (12), (13), (14), and (15),] relating to this system of water-routes, have evidently one prominent object—to determine the feasibility and advantages at the present time of carrying out Major Schalch's proposal to cut a Canal from Channel Creek to Tolly's Nullah. It is also evident that the leading idea, animating these queries, is the benefit to the shipping interest which would accrue from such Canal. Towards that object I frankly confess myself incompetent to afford any elucidation from personal experience. The relative merits of Channel Creek and New Harbour as a shipping station and the terminus of a route across country to Calcutta, have been much discussed since Mr. Hornemann's first Railway project of 1836: and the information then evolved is within reach of the Committee, as well as evidence from Members of the Pilot Service, who must be more familiar with the localities than any other class of persons. This, however, it may be permitted me to say, that from perusal of much of that information and conversation with parties acquainted with the spot, my own impression is distinctly, that neither a Canal nor a Railway communication to Channel Creek, will ever be of use to the shipping interest. The large development of Steam Tugging Companies has already shortened the distance from Calcutta to the sea; has, as a matter of course, diminished the dangers of the passage, and is gradually reducing its expense. We have a daily prospect of the determination of more capital to this branch of what I may term water-carriage: and with the increased competition we shall inevitably have, to judge by the short experience already obtained, more powerful boats and cheaper rates of tugging. Taking this into consideration, and combining with it the natural (perhaps irresistible) tendency for the interests concerned—the owner, the merchant, and the mariner—to be in as close proximity as possible, I do not think that any scheme for transferring the port of the Hooghly from Calcutta to Channel Creek has, as far as can yet be seen, a prospect of success, and for such purpose therefore, I do not think any advantage would follow from carrying out Major Schalch's suggested Canal.

4. In the other light, however, of opening up a new, cheap, and permanent communication to Calcutta, by which local produce may find its way into the market of the Metropolis, it is my decided opinion that the benefits accruing to the district through which it will pass, will fully repay the expense of the excavation, and that the direct Tolls upon the Canal, will be met by those desirous to avail themselves of it to a degree that ought to be considered pecuniarily compensatory by the authorities.

5. It is so difficult to get any precise numerical statistic data from the public records regarding the agricultural produce of any particular district, that I must be excused, if in submitting to the Committee some of the capabilities of the Twenty-four Pergunnahs, I do not appear to do so in the most available form. There are doubtless opportunities by which private individuals may attain to such data, but to take advantage of them where private interest is not combined with scientific curiosity, requires such direct personal labour and consumption of time, as it is scarcely fair to expect from men engaged generally in arduous and engrossing occupations.

6. The chief production of the Twenty-four Pergunnahs is rice, and that almost wholly of the finest qualities ; the amount of that production may be estimated when I state, that nearly all the table rice exported, during the late heavy shipments to England and the Continent from Calcutta, (that known as the *Patna,* properly *Putnai*) was the *bonâ fide* produce of this district. The great marts of Mograhat and Rajhat were, during that excitement, scenes of great interest: and agents have repeatedly gone through them, unable to procure rice of the indifferent quality, which it suited shippers to contract for. The grain of the coarser kinds which were secured for the Mauritius market, the Moonghee, is not the growth of this—but of the Backergunge district, the eastern, as this is the western limit of the Soonderbuns. A reference to the shipments made to Europe from August 1845 to March 1846, through the Custom House ; to the leading houses of agency making those shipments, and from them to their Banians or other contractors—a not difficult nor tedious series of references—would put the Committee in possession of a clue to the enormous amount which the Twenty-four Pergunnahs spared to the necessity of Europe.

7. This rice is derived from the whole surface of the district extending now to the eastward over the cultivated lots in the Soonderbuns, bounded on the southward by the same forest line till its junction with the Hooghly between George's Point and Culpee, and on the West by that river. A dead flat as the district is, it is as may be supposed intersected by a number of water passages, most of them not more respectable than broad ditches, but which are sufficiently broad and deep to admit, when there is any water in them, of the transport of produce on the *salties* and *donghas,* which form the boatage of the district. These are of various sizes from the largest class of the former, hollowed out of the " Saul" tree, capable of carrying eighty maunds, down to the little coracle formed of an excavated palm, barely floating with its single guide, who poles it forward with his bamboo *luggee,* keeping a careful look out at the thinner end, which has been stopped up with mud, forming, however carefully plastered, a but precarious excluder of water.

8. The water-courses of which I have spoken, are in communication one with another, so that in the rains, a complete navigable thoroughfare for the boatage which I have described exists in the district, and this lasts till January and February. A glance at the maps of the Twenty-four Pergunnahs, faulty in the extreme as most of them are, will shew how many communications the interior system of water-courses has with the Hooghly on the westward, with the Pealee Nuddee to the east and other Soonderbun streams to the southward. A clear navigation exists from Tolly's Nullah to Culpee in one direction, and to Soorjeepore and thence to the Gordah Sắlt Works on the other ; as well as from Soorjeepore to Culpee itself. We have thus the element of a perfect and permanent intercommunication through the heart of the district : an element, however, at present only available at a particular season.

9. During this season, the produce of the district is transported to the central marts in the craft I have described : at others on bullocks or, where roads permit, on carts. Sold there to the Calcutta Mahajuns or intermediate men, the produce is conveyed generally by the *seller,* now become *carrier,* to the neighbourhood of Calcutta. As regards the rice, this was very extensively done last season : boat loads purchased at Mogra and Soorjeepore being made deliverable at Chitla Hāt, on a small payment per boat for the carriage. Arrived at these suburban storehouses, the produce was sent into Calcutta by cart to the godowns of the contractor.

10. So extensive is the determination of produce of one kind and another towards Calcutta through this Southerly district, that in the commencement of April, a friend on whose accuracy I can rely, struck by the influx towards Calcutta, took a census one day of the carts passing his tent, then pitched at Corybarreah on the Diamond Harbour road, and

found them during one twenty-four hours, to amount to 413! I do not cite this to the Committee as an average, but at the same time, I think from my own knowledge of the district it ought not to be considered an extreme; but may be taken, with due caution, as an element of calculation.

11. Much of what I have hitherto said, has been with direct reference to the present staple of the Twenty-four Pergunnahs—rice. But indigo has been extensively tried in it at Sunkarypooker, Bykantpore, Soorjeepore, Bakra, &c.,—Silk at Bakra, Sugar at Barripore: and in no instance (I speak advisedly) have these experiments not met with full success from defects of soil. Relatives of mine have been connected with the district, one way or another since 1790, and their opinions I speak as well as my own. A Canal of about five miles long was commenced upon by my father in 1830 in the channel of an old one, twenty miles long, cut by Mr. Herbert Harris, from Allumpore just below the Semaphore Station at Moyapore, and extending to Jageerghat; and had not difficulties of a legal nature respecting the property of the ground intervened, the factory of Bakra, now known solely as a rendezvous for the Tent-club, would have become as valuable an indigo as it once was a silk factory.

12. My object in entering into all these details has been to lay before the Municipal Committee the importance of the Twenty-four Pergunnahs as a productive district. If I have not been able to adduce the most efficient data for the purpose, I have perhaps said enough to indicate to the Committee the sources from which more accurate statistics may be obtained. And my further object has been, thereby, to induce the Committee to reflect, whether, if by a modification of, or collateral additions to Major Schalch's Plan, a permanent water communication cannot be kept up through the district, developing its resources, such as they are, and through its better cultivation leading to the more effectual concentration of the social forces upon what, I believe I am not wrong in thinking, one of the original ends of the Committee's labours, the advancement both of the wealth and the sanatory condition of Calcutta by the clearance of the Soonderbun forest.

13. The measure which I am led to think would be most effectual for this purpose, would be a central Canal, such as that proposed by Major Schalch extending from Tollys' Nullah—not however to Channel Creek—but to Culpee. This Canal with locks would be the primary artery of communication: and with it might be combined the opening up of a permanently navigable route to Mograhat, and thence to Soorjepore, by several short cuts, some of them about half a mile, others a few hundred yards, quite sufficient to admit of the passage of such boatage as is now in use, at all seasons of the year. Fed as the central Canal will be by tidal influence, its secondaries will be similarly acted upon, and thus the peasantry of the district will have open to them, the most convenient and cheapest roads for the transport of their produce which the nature of the locality admits of.

14. It is with the utmost deference, that I lay these opinions before the Municipal Committee, for I feel that I am pressing them towards a point which may not quite consort with the theories in vogue. The present principle of opening out inter-communications, is too much, I fear, pursued with regard to the interests and views of the capitalist, trader, and distributor, than the interests of the labourer-producers. The one it is true cannot be advanced without advancing the other: but those who have watched the history of the last few years, must feel that the disproportion of the two progresses is extreme, and that from that very disproportion arise new relations acting detrimentally upon the weaker producers. Struck by the magnificent result, the accumulated wealth, we consult both in our lines of intercommunication and our methods of carriage, more the immediate interests of Capital than of Labour. This is beginning to be felt in Europe; in India may we not profit by that experience? May we not at least while paying full attention to the claims of capital, pay also more attention than has yet been done to the claims of labour? While

perfecting by railroad the communication between the centres of Commerce, may we not also seek to benefit the masses by increasing the facilities of village intercourse, through opening out such permanent roadways, either solid or liquid, as are cheapest and best adapted to the locality. By spreading over the face of every district such reticulations of thoroughfare, we do an immediate benefit to the peasantry, and we confer, if not an immediate, yet a permanent benefit on the capitalist, by ensuring to his great marts a regular supply, as well as an extensive, of their feed.

15. With this statement, I quit this portion of the subject. If the Committee are desirous of following it up, I shall be happy to enter into it in fuller detail, and even to obtain the requisite statistical data, which I feel assured will convince the Committee that the good effected, and even the pecuniary return obtained, would warrant a recommendation to the Government to undertake such a central cut from Tolly's Nullah to Culpee; accompanied by deepening and extending channels in existence, so as to produce a system of water communication extending through the Twenty-four Pergunnahs available at all seasons of the year.

II. Upper Hooghly navigable system.

16. On this line I have nothing to say, beyond that the development of the Railway system, which in this direction is inevitable, renders the execution of the Rajmahl Canal referred to in query (10) perfectly futile as a superseder of the Soonderbun route for the commerce of the Upper Provinces.

III. System of Eastern Canals.

17. This system, as it at present exists, is composed of Tolly's Nullah, the Circular Canal, the Balliaghat Canal, the Lake Canal, the Bhamunghatta Canal, the Doodbeebee Canal, the Chultabarreah Canal, the Bhangor, the Choitol, the Bhowanneepore, the Choolkonee, and the Hoseinabad Canals.

18. With regard to the present navigable state of these Canals, the shallowness of Tolly's Nullah renders it little frequented in comparison to the Balliaghat route, even by boats coming up from the Attarabanka line of navigation and taking their choice of passages at Tarda. Still so large is the influx to Calcutta from the Eastward, that the passage of boats through and their congregation in Tolly's Nullah is, even at this day, an obstacle to rapid transit. The exact tonnage flowing through any Canal I am unable to give, but it may, I think, be gleaned from the amount of tolls collected respectively at Balliaghat and the entrances to Tolly's Nullah.

The complaint of stoppage by the congregation of boats, justified by the state of Tolly's Nullah, is still more justified as regards the Balliaghat and the Circular Canal, especially near their junction with the Entally Canal, at the Tremonee, as it is termed.

This conversion of what was intended as a passage into a harbour, is a primary evil that is not quite met by the regulation permitting a boat to remain tax free between the toll gates for not more than 14 *days. The large 800 and 1200 maund boats with chunam from Sylhet, rice from Burrisaul, and wood from the Soonderbun *Cala jungul* are carriage of too large calibre to remain in the Canal, even for that period; succeeded as one set is by another. The individual stoppages may be temporary; the obstacle to free navigation is permanent.

We have other obstructions to navigation in these terminal Canals in the contracts made with fishermen whom, where natives are concerned, I have known stoutly to dispute passage when their nets were being drawn, and—backed by peadas of parties whom

* ? 3 days.—J. M.

they called their Zemindars—positively to seize and fine boatmen who have persevered to force a passage at the risk of injury to the nets, which of course were declared to be irremediably injured.

We have further obstructions in the same Canal presented in the extortion practised by the toll-gatherers. A boatman coming in with a fair tide and anxious to avail himself of it to reach Calcutta with as little delay as possible, finds himself obliged to fee the men to get his ticket for him in time. If inflexible, he may cool his heels as long as it suits the unfeeds', as a plausible excuse is easily got up, during the crush of boats to get in or out, for serving some one else before him. Owing to the illiterate character of boatmen, generally, I should not wonder if it were often attempted to take from them a larger sum than a receipt is given them for, which receipt is properly calculated. I give this as my opinion, because I have seen it sometimes practised, and see no reason therefore, being tolerably familiar with the character of the Bengallee underlings, why it should not be tried on, whenever possible.

Besides the extortions of the Toll gatherers, the navigation by the Canal route has to bear up in many cases against those of the Salt Chokies. There is one of these half-way in the Chultabarreah Canal, and another at Rogepore at the Eeshamuttee extremity of the Hoseinabad Canal; both of which are notoriously lucrative places, and the officials of which, I have seen receive as much as an eight anna piece at a time from a Backergunge boat; others pay in kind—some by a *pallee* of rice; others, by a fowl; and so on. I have known boats, emboldened by seeing a *Saheb's* boat in the neighbourhood, refuse to pay the demand and been accordingly chased and boarded by men from the *chokie* in the little coracle they have always at hand; and when I interfered and boarded the boat simultaneously with themselves, I have been met with the utmost effrontery and coolness, and though I heard their previous demands, have been told that they were only in the exercise of their duty searching for illicit salt. I regret to say that on some occasions when I have brought this matter to the notice of the proper authority, I have been told it was impossible to be rectified; that if one chokei man was dismissed, a still more hungry and, therefore, more rapacious successor would be appointed; and was significantly reminded of the fable of the Hedgehog and the Fox. I have indeed been entreated on one occasion, by the sufferer himself, not to interfere, as he would only suffer doubly and under greater malice when I was out of the way, as his avocations made him a constant passenger by the route. The remark was too sensible not to be followed, and I have since contented myself with accurate observation in hopes of an opportunity, like the present, when radical reform might be effected.

Beyond extortionary obstructions, we have navigatory ones. These are:—

1. *Lesser obstructions;* { Fisherman's stakes. Sunken boats. Stumps of trees. Tracking paths impeded by jungle. Tracking paths impeded by intervening *Khals*.
2. *General want of depth in the system of Canals;* especially at Choolkonee, Bhowanneepore, and Bhangor.

The streams, under tidal influence, run so strong in the Soonderbuns, that at the coming in of the flood, for instance, it is in some of the Canals hazardous to start till the whole current is running at a uniform rate. With such rushes it will be easily understood how in or at the mouth of narrow straight water-ways as the Canals all are, the dangers of stakes, sunken boats and tree stumps, are more than ordinarily, great and less, evitable. Wrecking is too much of a profession among the population on Soonderbun grants to render the clearance of the channels by the residents on their banks a matter of probability. Sometime ago, I applied to several of the River Insurance Offices in Calcutta for a statement of the losses they had suffered within the previous five years from losses of boats in the Soonderbuns. This of course would have included the Attara Banka as well as the Canal Route, but the answers were to the effect, that though perfectly sensible of having lost much by the routes in question, they were not in a position to say how much, or where. The parties at the same time cordially concurred in the wish that I would represent the matter to the proper authorities, which I did, but nothing came of it.

One obstruction in regard to tracking paths, is the jungle which extends to the water's edge, and in case of adverse tides prevents the use of the tracking rope. Regarding this jungle, it must be understood that as concerns allotments of Government lands to Grantees, it grows upon land that is specially reserved by Government for the construction of tracking paths. All our pottahs—I speak as owner of several of these grants—except from the grant a strip of land 60 feet wide, bordering on the Canals. Under these reservations it is a little too much to expect us to do for Government, what it contemplated doing for itself, and which drawing the revenue it does from the Canals, it is so much better able to do. It must further be recollected, that the jungle left on this strip of land is as good as a hedge to the cultivated portion of the lot beyond, against the incursions of the predatory boatmen, a race well known in the Soonderbuns.

In spite of these considerations, several grantees—I think I may name Messrs. McPherson and Harris among the number—have offered if Government were to clear the jungle in question, they would prevent its becoming an obstruction again, and would give their own bunds as tracking paths for the passing boatmen in order to get rid of the eyesore which the jungly appearance of the banks made them. The offer, as far as I can recollect, was declined on the ground that the fund set apart for the repair and improvement of all the Canals (being 700 Rs. a year !) was inadequate to the disbursement required. Understanding as I do that the annual income drawn, in net, from the Canals is 1,50,000 Rs., this 700 Rs. is about the smallest per centage that was ever allowed in any mercantile speculation for wear and tear of block.

The other obstruction to uniform tracking is the interruption offered by little *Khals* or streamlets, just too deep to be forded, especially where alligators are not wanting, and too narrow to make it worth while to take the trackers on board to the other shore.

The greatest drawback however, upon the usefulness of the Canals, is their general want of sufficient depth. Commencing at the Entally Canal, we find it converted into little better than a wet dock for middle sized boats. The Circular Canal itself, though about the best scoured, is not passable with facility in every part at any time. Even in the Lake Canal which is the deepest, there is at the toll gate terminus a bar affording serious impediment when the ebb runs low. In the Chultabareah Canal there are portions which we may call just wet at low water, and the same in the Bhangor Canal, above and below the *haat*. As for the Bhowaneepore and Choolkonee Canals they are in parts perfectly dry at half tide, and their utility as part of a continuous system of Canals is rendered entirely nugatory by the circumstance. I have come from Bagundee down the Eeshamuttee and the Hoseinabad Canal, starting with the the first of the ebb, and been, though going in a light and fast pulling *pansway*, stopped for want of water at the mouth of the Choolkonee, which was then completely dry. The loss of time thus incurred by the larger class of boats is great, in waiting out the last half of the ebb and the first half of the coming tide to get through this one Canal, after which they are obliged to track through the next Canal of Bhowaneepore against the remainder of the flood, till they come to the Akratulla, when the flood which would there become favourable has run out. Every start in these Canals for boats beyond a very small size is regulated by the tides, and a very annoying interference with the comfort of travelling by the Canals is thus occasioned by the shallowness of these two in especial. In 1840 my father, then the owner of the grants on both sides of the Choolkonee and of the grants on the northern side of the Bhowanneepore Canal, remonstrated with the Canal Office on their state, and strongly urged re-excavation, but the answer was that the pressure of the Affghan war permitted no such undertaking. The consequence is that the larger boats, those above 700 maunds, from the eastward in fair weather, prefer the Attara Banka route in choosing at Goodlad's Creek, as the less harassing, and scarcely more tedious. I say scarcely more tedious because I have during spring tides in February, gone in a large English built cutter, using her sweeps, from Balliaghat to Hoseinabad by the Attara Banka in two days. I may state here with reference to the question to that effect, that I do not, from what I have seen of it, think the Attara Banka passage, dangerous at present. Cultivation is beginning to fringe it on the northern bank of the line, and the intervals between the haunts of population is daily diminishing. The improvement of the Canal line is now, I apprehend, desirable upon other grounds than the pure dangers of the lower route. The larger Boats those above 1000 maunds, there are some as high as 5000, will naturally prefer the wide channel and sailing room of the broad rivers, and these will consequently convey the trade of Arracan, Chittagong, and Sylhet, while the more compact and smaller boats from Dacca, Mymensingh, Rungpore, Furreedpore and Jessore coming from a higher latitude, will be glad to avail themselves of the route so much higher up and in a nearly straight direction; economising time and ensuring safety; results that will be still further identified if the remainder of Major Schalch's plan is carried out by the completion of the line to Khoolna.

19. From the lengthened statement I have given above of the present character of both the Eastern routes, the Committee will readily elicit the opinions I hold of their advantages and disadvantages—that neither is likely to be altogether superseded by the other, that both have defects but not any radical—and that the defects they have are capable of amelioration if not of entire cure.

20. The obstacles and impediments to the Canal Navigation, enumerated as above, almost suggest their own remedies.

The first thing required is to give the fullest effect to the system now in existence by deepening the several portions choked up, and resorting to some comprehensive plan—one if I mistake not, was proposed by Capt. Prinsep when he superintended the excavation of these Canals—for periodically scouring them. As this is a matter of engineering detail, I shall not presume to say any thing further upon it, feeling sure that it will present no difficulties to the able officer in charge of the department.

The second, would be to assist boatmen in making themselves independent of tides, so far as accident may render requisite, by the construction of a continuous tracking path on both sides of the line of Canals, and (I should say) such connective streams between the Canals themselves, as the *Choumookee*. The tracking path should be a solid bund placed at least 20 feet from the water's edge for permanence sake, in which case the first expence would be all that would have to be met; and I might safely say that, as far as is bordered by Soonderbun grants, not a Grantee but would relieve the Government from all future expense as to their preservation in perfect efficiency, the mode and extent of repair being prescribed by the Canal Engineer. Besides this uniform line of tracking bund, I would suggest the erection of small cheap wooden bridges over such intervening Khals in the line, as the interests of landholders might induce them to keep open; there being very few of them so required.

21. The next point to be considered is the formation of an efficient Police devoted exclusively to the superintendence of the Canals. There will be no lack of duty for such an establishment; to watch over the navigable state of the line, to report obstructions, to inquire into reported cases of extortion and bring the offenders to punishment—we have the nucleus of such an office in the Superintendency of Canals and Bridges, but much larger European assistance in the subordinate parts appears requisite. There should be at least two

European patrol-overseers circulating through the Canals from end to end and time to time. It would be the only cheap and (with cheap,) effective way of securing the objects aimed at, as equally honest, experienced, active, and able Native agency for such purposes could not be had for the same remuneration. With *eyes* and *hands* of this character, the Engineer officer (invested at the same time with magisterial powers) who presides over the Canals' and Bridges' Office of Calcutta, will be adequate, with very little additional establishment, to the complete control of the Eastern Canals as the system exists. Should additions be made to the system, they of course will necessitate an increase.

22. That some additions are requisite and others desirable, is I think undeniable.

The most prominent is a harbour at the entrance of the Balliaghat Canal, to contain the boats that do not pass directly into the Hooghly, or require more than two days to unload their cargo. There is at the spot indicated the nucleus of such a wet dock, but it is not large enough. One sufficiently large to hold the entire amount of boatage now frequenting the Canal would be a desideratum: the earth from the excavation being used to solidify the banks of the docks towards Calcutta to allow of the erection of Store-houses for the cargoes which, when the docks come into use, will have necessarily to be there erected. By such a measure the Canals (Balliaghatta, Circular, and Entally) will become the free passages they were intended for; they will be more freely ventilated and cleansable, and the neighbourhood, now unpleasant, become more healthy. At the same time the extension of the suburbs eastward will permit of local improvements which at present are utterly impossible. Along with the wet-docks, we may have a tram-road constructed on the southern bank of the Balliaghat and the Entally Canal from the docks to the Dhurrumtullah road, giving the greatest facility to the transport of those heavy articles of trade, which to secure us the convenience of Canal transit will be necessarily disembarked at the Dock-storehouses. The ground indicated for this tram-road, is now partly choked up by fences and old walls and is partly a most wretched hackery road, dangerous to the last degree in the rains from its heavy ruts and abutment over against the Canal.

23. Another addition to the present systems of Canals, that I would suggest, is a Canal between the two Soonderbun allotments known as Nos. 19 and 20 of Capt. Prinsep's Map B. Its value and advantages were brought to the notice of Capt. Boileau in 1840 by my father, and are so fully detailed in the communication (now I believe in the hands of the Committee) on that occasion, that I shall not needlessly attempt to recapitulate them. The suggestion met with Capt. Boileau's fullest approval, and nothing but the pressure of the Affghan war (we were told) prevented it from being then carried out.

24. The extension of the Canals to Khoolna according to Major Schalch's original plan is an idea, the commercial results of carrying which out, there can scarcely be a question, will be very beneficial. It will give a direct and safe passage to the Jessore inlets, obviating the necessity of the circuitous and sinuous passages by the Cobbaduk and Goodlad's Creek. Of its engineering difficulties a survey by a professional officer, will give the best idea and elicit the grounds upon which the plan as originally devised, or with local modifications, may be embodied in a formal report. However there is enough of time for this, when the more immediate necessities of the Eastern Canals have been provided for: *they* are urgent.

25. The Attara Banka route will improve as the cultivation on its banks extends: and that extension will be only a sequel to the cultivation of the Northern grants. These are progressing, and their clearance and settlement will be accelerated as the Canal route is improved. A determinate pressure once given to clearance southward, the move of improvement will be determinate. The causes that have hitherto hindered such regular and uniform clearance are connected with a subject which is irrelevant to the Committee's inquiries and which, it may therefore be considered necessary to apologize for having alluded to.

26. In suggesting a regular Police of the Canals, I of course include among its functions the eradication of all the dangers attendant upon the passage, and otherwise increasing its comforts. To one particular however, the digging of a large tank at each of the anchorages (if I may so term them) on the route, the attention of the Committee may perhaps be advantageously directed, as the increasing resort through the Canals renders it impossible for the Grantees on the banks to supply water to all comers from their own stores. Our own population take up our care, and with their wants in the dry season we have enough to do.

27. I have now, as far as my recollection goes, laid before the Committee thus much of the information at my disposal as appears to bear upon its objects. If there are more specific queries which it is desirable to aid in answering, I shall be happy to do so if they are within my ability.

I have the honour to be,
Sir,
Your most obedient Servant,
S. G. TOLLEMACHE HEATLY.

Garden Reach :
June 1st, 1846.

No. XXXVI.

No. 43.

To THE HONOURABLE SIR J. P. GRANT,
Chairman of the Municipal Inquiry Committee.

Sir,
Calcutta, 16*th June*, 1846.

In reply to your Letter No. 3064, of the 15th instant, I have the honour to inform you, that the repairs to the banks of the Soondurbun Canals therein adverted to, were duly executed under the superintendence of Captain Goodwyn, agreeably to his Estimate sanctioned by Government on the 24th September 1843.

2nd. The Estimated Expense of the above repairs was Rupees 4,368, but the actual outlay appears to have been Rupees 3,726: which sum is included under the head of "General Current Expenditure" for 1844-45 in the "Return of Expenditure on the Canals," furnished to the Municipal Committee along with my Letter No. 29, of the 5th August 1845.

I have the honour to be,
Sir,
Your most obedient Servant,
W. RUTHERFORD, *Captain*,
Ex. Officer of Canals.

No. XXXVII.

No. 3025.

To CAPTAIN W. RUTHERFORD,
Superintendent of Canals.

SIR,

Under instructions from the Chairman of the Committee upon Municipal Improvements, the Honourable Sir J. P. Grant, I am directed to draw your attention to the annexed communications, and with reference to them to request the favour of your furnishing the Committee with a Copy of the separate or joint Report of Captain FitzGerald and Captain Goodwyn, if such Report was made, upon the difficulty or otherwise of Damming up the Gobra Khal, with reference to an Estimate No. 7, for the above work, by Captain Goodwyn, submitted to the Military Board *in June* 1843.

I have the honor to be,
SIR,
Your most obedient Servant,
(Signed) J. MORRIS,
Clerk to the Committee.

MUNICIPAL OFFICE, TOWN HALL:
2*nd January*, 1846.

No. XXXVII. *a.*

No. 3015.

To CAPTAIN H. GOODWYN,
Civil Architect.

DEAR SIR,

With reference to an Estimate No. 7, submitted by you to the Military Board through the Superintending Engineer L. P. (Captain FitzGerald), *in June*, 1843, of the probable expense of Damming up the Gobra Khal, amounting to Rs. 5,347:6:0, and which the Board, at the suggestion of Captain FitzGerald, declined approving till Captain F. and yourself were able, at a more favourable season, to become better acquainted with the difficulties, &c. of the work, I am directed by the Chairman the Honourable Sir J. P. Grant, to inquire of you whether Captain FitzGerald and yourself took measures of informing yourselves further upon the subject, and if so, what was the result, and whether the result was reported to the Board.

I am, Dear Sir,
Your's faithfully,
(Signed) J. MORRIS,
[*Clerk to the Committee.*]

MUNICIPAL OFFICE, TOWN HALL:
26*th November*, 1845.

No. XXXVII. *b*.

To J. MORRIS, ESQ.,
Town Hall.

Dear Sir,

I did send in a Report and Estimate for the Gobra Khal work, and the reply of the Superintending Engineer and Military Board will be found, together with my Report and all other information, in the Office of Captain Rutherford, the present Superintendent of Canals, in " Camac Street." The exact purport of the Board's reply I forget, but the cost of the work was deemed disproportionate to the anticipated benefits.

Your's faithfully,
(Signed) H. GOODWYN.

(A True Copy.)
(Signed) J. MORRIS,
Clerk to the Committee.

No. XXXVIII.

No. 254.

To J. MORRIS, ESQ.,
Clerk to the Municipal Committee.
Calcutta, 9th January, 1846.

Sir,

In reply to your Letter No. 3025, dated the 2d instant, annexing Copy of Correspondence with Captain Goodwyn, I beg to state for the information of the Chairman of the Municipal Committee, that subsequent to the transmission of Estimate No. 7, dated 30th June, 1843 to the Military Board, there is no Copy or record in this office of any Report on the expediency or otherwise of Damming the Gobra Khal, either from Captain Goodwyn or the late Major FitzGerald.

2nd. A Copy of the former Officer's Letter, forwarding the Estimate in question, and of Major FitzGerald's reply, No. 1704, dated 18th September 1843, is annexed, but no communication on the subject of a later date is forthcoming.

I am, Sir,
Your obedient servant,
W. RUTHERFORD, *Captain,*
Ex. Officer, Canals.

XXXVIII. *a.*

No. 148.

From CAPTAIN H. GOODWYN, *Engineers,*
Superintendent of Canals,

To MAJOR FITZGERALD,
Superintending Engineer, South Eastern Provinces
Calcutta, 22nd July, 1843.

Sir,

I have the honour, in obedience to your No. 818, of 5th instant, to forward the Estimates for the reconstruction of Tow-paths and Damming the Gobra Khal, with the Sections and Sketch required. The Tow-paths of the Hosynabad and Baley Gunj Canals require only repair, and are charged at 10 Annas per 100 feet only.

I have, &c.,
(Signed) H. GOODWYN, *Captain, Engineers,*
Superintendent of Canals.

No. XXXVIII. *b.*

No. 1704.

From MAJOR W. R. FITZGERALD,
Superintending Engineer, South Eastern Provinces,

To CAPTAIN GOODWYN, *Officiating Agent for Iron*
Suspension Bridges and Superintendent of Canals.

Sir,

In reply to your Letter No. 148, dated 22nd July last, I have the honour to mention, under instructions contained in the Secretary Military Board's Letter, No. 3,194, dated the 9th instant, that as the Board doubt the practicability of Bunding up the Gobra Khal, with reference to former Correspondences on the subject, they have transmitted to me the accompanying original papers as per margin,* and I forward them to you to enable you to investigate better the expediency of attempting to Dam the Khal in question.

* Proceeding, 13th April 1837, E.
Proceeding, 15th June 1837, 4.

2nd. Your Estimate for making improvements to the Soondurbun Canals has, the Board inform me, been recommended to Government.

I have, &c.,

Calcutta :
18*th September,* 1843.

(Signed) W. R. FITZGERALD, *Major,*
Superintending Engr., South Eastern Provinces.

(True Copies.)
W. RUTHERFORD, *Captain,*
Executive Officer, Canals.

Statement of the Surplus Tolls from Tolley's Nullah and the Balliaghatta and Circular Canals in the hands of the Government, after allowing for the payment of all Charges incurred on the above Canals and the Cost of their Construction to the Honorable the East India Company.

Circular Canal.						
Gross Collection of Tolls on the Circular Canal, from the date of its completion in November 1831 to 1st November 1836,		18,858 14 5				App. (I) No. 44 $a^{(3)}$ page 66.
Deduct Charges on ditto, during the above period,		7,116 2 0				
			11,742 12 5			Ibid.
Gross Collection of Tolls on the Circular Canal under the *new* arrangement, from 1st November 1836 to 30th April 1845,		8,09,474 3 4				App. (J) No. XVI *a* page 105.
Deduct Charges on ditto, during the above period, viz.						
Total of General Current Expenditure from November 1836 to 30th April 1845,	2,01,893 3 9					Ibid, No. XVII *a* page 107.
Deduct Expenses incurred on the Soondurbun Canals included in the above, but to be debited to the Circular Canal,	6,506 5 9					
Ditto *Half* of the above Balance of the General Current Expenditure as chargeable to the *Circular* Canal and the other Half as chargeable to Tolley's Nullah,	½)1,95,386 14 0 97,693 7 0					Addenda to App. to App. H.
Add Soondurbun Canal Charges deducted from the General Current Expenditure noticed above,	6,506 5 9 1,04,199 12 9					
Add Estimated Repairs to the Circular Canal,	61,133 10 7					
Total Expenditure on ditto,		1,65,333 7 4				
			6,44,140 12 0			
				6,55,883 8 5		App. (J) No. XVII *a* page 107.
Add Rent from Circular Canal Lands from 1831 to the 30th April 1845,				27,283 0 0		App. (J) No. XXIV *a* page 114.
Ditto from Ferries, Fisheries, Fines, &c. on the Circular Canal, from 1st November 1836 to 30th April 1845,				13,980 12 9		Ibid, No. XXIII *a* page 112.
				6,97,147 5 2		
Deduct Nine Years' *Net Income* of the Balliaghatta Canal, from 1st November 1836 to 30th April 1845,—the annual average of the same being Rs.* 14,556 : 14 : 2, framed upon the average Receipts of the last Nine Years *preceding* the 1st of November 1836, to be carried to the Credit of the Balliaghatta Canal,				1,31,011 15 6		App. (I) No. 44 $a^{(1)}$ page 64.
Net Balance in favour of the Circular Canal, *exclusive* of the Cost of its Construction which will be found deducted below,					5,66,135 5 8	
Balliaghatta Canal.						
Gross Collection of Tolls on the Balliaghatta Canal from 1810-11 to 1st November, [? 31st October,] 1836,			4,28,842 8 1			App. (I) No. 44 $a^{(1)}$ page 64.
Add average *Net Income*† of Tolls on ditto, from 1st November 1836 to 30th April 1845, *deducted* from the Tolls on the Circular Canal. The average framed upon the Receipts of the last Nine Years on that Canal *preceding* the 1st November 1836 as noticed above,			1,31,011 15 7			
				5,59,854 7 8		App. (J) No. XVI *a* page 105.
Add Revenue derived from the Balliaghatta Canal Lands from 1810-11 to 1825 inclusive.—*No Return* of the Revenue of *these* or more *remote* years is before the Municipal Committee,				0 0 0		
Ditto from ditto from 1826 to 30th April 1845,				45,916 6 6		Ibid, No. XXIV *a* page 114.
				6,05,770 14 2		
Add Revenue derived from the Balliaghatta Canal Ferries, Fisheries, Fines, &c. from 1810-11 to ? 1836-37 or 1845, *Nil*—there being *No Return* of *these* or more *early* years before the Municipal Committee which specifies this Revenue,				0 0 0		
Deduct Total Expenditure on the Balliaghatta Canal, including the Expense for Improving the Navigation and the Toll collection, &c. from 1810-11 to November 1836,			62,863 4 2			App. (I) No. 44 $a^{(1)}$ page 64.
Ditto Original Cost‡ of Constructing the Balliaghatta Canal and Purchases of Ground,			1,53,720 2 11			App. (I) No. 49 $a^{(1)}$ page 78.
				2,16,588 7 1		
Net Balance in favour of the Balliaghatta Canal,					3,89,182 7 1	
Tolley's Nullah.						
Gross Collection of Tolls on Tolley's Nullah, from 1804 to 1st November, [? 31st October] 1836,			22,75,020 10 1			
Add ditto on ditto from 1st November 1836 to 30th April 1845,			4,70,700 2 2			App. (I) No. 44 $a^{(2)}$ page 65.
				27,45,720 12 3		App. (J) No. XVI *a* page 105.
Add Rent from Tolley's Nullah Lands from 1804 to 1825—*No Return* of the Rent of these years is before the Municipal Committee,			0 0 0			
Ditto from ditto from 1826 to 1845,			1,175 12 2			
Ditto Rent from Ferries from 1804 to 1835-36, (*No Return*,)			0 0 0			
Ditto ditto from ditto from 1836-37 to 1844-45,			1,361 15 9	4,642 1 0		App. (J) No. XXIII and No. XXIV pages 112 and 114.
Ditto ditto from Fisheries from 1804 to 1836-7, (*No Return*,)			0 0 0			
Ditto ditto from ditto from 1836-37 to 1844-45,			2,104 5 1			
				27,50,362 13 3		
Deduct Total Expenditure on Tolley's Nullah, from 1804 to 1st November [? 31st Oct.] 1836,		2,66,108 6 10				
Deduct Half of the General Current Expenditure from the 1st November, 1836 to 30th April 1845, chargeable to Tolley's Nullah, the other Half having been debited to the Circular Canal as noticed above,		97,693 7 0				Ibid, No. XXVI *a* page 105.
			3,63,801 13 10			
Deduct Estimated Repairs to Tolley's Nullah during the same period,			13,850 6 9			
				3,77,652 4 7	23,72,710 8 8	App. (J) No. XVII(*a*) page 107.
Deduct the Cost of Constructing the Circular Canal and the Purchase of Land,			14,80,408 0 0		33,28,028 5 5	App. (I) No. 48 page 73.
Ditto of Constructing the Soondurbun Canals,			3,33,650 15 8			Ibid, No. 37. page 57.
				18,14,058 15 8		
Deduct as already charged in the outlay of Rs. 6,506 : 5 : 9 above noticed, Rs.				813 7 8		
					18,13,245 8 0§	
Net Balance in favour of the Calcutta Canals, EXCLUSIVE *of Interest on their Annual Surplus Revenue, which Interest, if calculated, it is supposed would amount to a very considerable sum in favour of the Canals,*					15,14,782 13 5	
VALUE of the Circular, Entally, and Balliaghatta Canals, EXCLUSIVE *of Tolley's Nullah*, estimated by their Rental, i. e. the Amount that would be required as a Principal to yield at 5 per cent. per annum, the Amount of the Annual Revenue of the above Canals, Co's Rs.					28,00,000 0 0	

JAMES MORRIS,

Clerk to the Committee upon the Fever Hospital and Municipal Improvements.

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* The average Annual *Net* Toll of the Nine years immediately *preceding* the Improvements made in 1823-24, by Major Schalch in the Lake Channel and Soondurbun Canals was Rs. 13,432 : 11 : 10.

† The *Return* from which the above Net Income of Tolls is taken (See Appendix I. page 64) does not state whether the Net Income of Tolls includes the Rent derived from the Ground on the banks of the Balliaghatta Canal and from the Ferries and Fisheries of that Canal or otherwise,—but it would appear from the circumstance of the Collector of Calcutta having furnished a *separate Return* of the Rent derived from the Balliaghatta Canal Lands and Ferries, from 1826 to 30th April 1845 amounting to Rs. 45,916 : 6 : 6,—that the above items of Revenue are *not* included in the Net Income of Tolls, i. e. from the year 1826 to 1845—should this supposition be correct, the Amount of the Revenue from the sources above noticed, to be deducted from the Revenue of the Circular Canal, should be added to the *last* Nine Years' *Net* Income of the Balliaghatta Canal noticed above.

‡ In this sum is included Rs. 61,098 : 4 : 4 incurred in the purchase of Ground for the Balliaghatta Canal in the years 1799-1800 1808-9-10, as this sum therefore is debited, the Tolls from 1799 or from the earliest period should also be credited or brought to account, but there is *No Return* before the Municipal Committee of the Receipt of Tolls on the Balliaghatta Canal previous to the years 1810-11, though Major Tolley in his Correspondence with the Government in 1777 makes mention at that period of Tolls being levied at Balliaghatta.

§ It is apprehended that this sum is rather in *excess* than otherwise, as it is supposed that it contains charges which have already been charged under the head of the Annual General Current Expenditure on the Calcutta Canals.—J. M.

No. XXXIX½.

Statement taken from Returns furnished to the Military Board by the Accountant General and the Superintendent of the Nuddea Rivers, of the Surplus Tolls in the hands of Government, from the Nuddea Rivers otherwise called the Bhaugaruttee, Jellinghee, and Mattabanga Rivers from the year 1824-25 *to* 1843-44.

Years.		Expense for improving Navigation, &c. including Superintendent's Salary and Establishment.	Expenses on account of Toll Collections.	Total Expenditure.	Gross Collections.	Surplus.	
1824-25 to 1829-30	As per Statement furnished by the Accountant General, ..	2,13,342 10 11	1,04,076 15 3	3,17,419 10 2	5,70,120 3 0	2,52,700 8 10	Appendix (1) No. 44, *d.* page 70.
1830-31 to 1839-40	As per Do. by Captain Smyth, vide Proceedings, 9th Feb. 1841,	3,28,397 3 10	1,48,712 6 4	4,77,109 10 2	15,97,289 5 9	11,20,179 11 7	
1840-41 and 1841-42	Ditto ditto, ..	53,119 14 10	35,456 14 6	88,576 13 4	4,52,465 9 6	3,63,888 12 2	
1842-43	Ditto ditto, ..	27,691 12 2	27,570 1 2	55,261 13 4	2,46,991 15 7	1,91,730 2 3	Ibid.—No. 49, page 77.
1843-44	Ditto ditto, ...	30,777 5 4	21,027 6 8	51,804 12 0	2,33,091 13 0	1,81,287 1 0	
		6,53,328 15 1	3,36,843 11 11	9,90,172 11 0	30,99,958 14 10	21,09,786 3 10	

JAMES MORRIS,

No. XL.

Extract of a Pamphlet entitled Observations on the advantages of a Wet-Dock, for the Port of Calcutta.—[*Calcutta: printed at the Mirror Press, by P. Crichton,* 1824.]

" As connected with a Wet-Dock at Kidderpore, a Canal for Ships from it to Channel Creek will be attended with the most important advantages to the Shipping and to the Port of Calcutta, and will complete the chain indeed of which the Wet-Dock can be considered only as the first link.

" In the observations on the advantages of a Wet-Dock, the difficulties of the River are stated generally, but on the present occasion it will be proper to go more into detail, to shew the necessity of some plan to overcome them, and which can so admirably be accomplished by means of a Canal.

" During the months of March, April, May and June, the difficulty of Ships getting down the River from the violence of the Southerly wind is great, and is attended with the most serious expences in the loss of Anchors, attendance of Pilots and Boats, and detention; causing demurrage—Ships are not unfrequently two or three weeks getting from Calcutta to Saugor, and are exposed during the whole of the time to great risks from violent Flood Tides, North-westers, and Bores—damaging their Sails and Rigging, losing their Anchors, and often injuring their hulls on the numerous and dangerous Sand Banks. —The James and Mary Sand alone, it may be assumed on a moderate calculation, costs every Ship proceeding down the River during these months, a loss of three days, and one anchor.

" The month of July is perhaps the period of all others when Ships go up and down the River with the fewest impediments—the violence of the Southerly Winds and Flood Tides abate considerably during this month; there are no Bores, and the Freshes have not become strong.—These four weeks may therefore be considered as the least unfavourable for Ships proceeding both up and down the River during the year.

" August ushers in the Freshes—During this month and September, and also the half of October, the impediments presented to the progress of Ships up the River, are many, and are attended with great risk from the violence of the Freshes, the sudden coming in of the Bores, and the frequent Gales from the East; the South-east, and the North-east, especially in the latter months—Ships are not unfrequently five and six weeks in getting up to Calcutta, exposed during the whole of the time to a Fresh which often runs eleven knots an hour, and lose anchors, besides suffering severe injury—not to mention the frequent wrecks which happen in the River every year.

" During the months of November, December, January and February, the danger is much lessened, yet the passage up the River is tedious and attended with delay—so as to make it a great inconvenience, and expence to Ships proceeding upwards.

" Thus it appears that during the year, four months are attended with extreme difficulty, danger and delay in getting down the River; three months equally so in getting up; leaving but one month out of twelve, in which with tolerable facility a Ship can proceed up or down, this most formidable River.

" To mitigate these obstacles to the progress of Ships navigating the Hoogly, various plans have been devised.—It has been proposed* to cut a Canal between Diamond Harbour and Fultah, so as to avoid the James and Mary, the most dangerous Sand in the River, and the public attention has been lately drawn to the towing of the Ships by Steam Boats.—The adaption of the power of Steam to Vessels will most assuredly form an era in Maritime affairs, and not the least to that of towing Ships—but to compare the assistance of Steam

* See App. (J) page 124, to Municipal Committee's 2d Report.—J. M.

Boats to the effectual remedy afforded by means of a Canal, would be like giving the preference to towing Ships round about through the Pentland Firth rather than going through the Caledonian Canal—and expensive and useful as that grand work has been, it is not more necessary than a Canal from Calcutta to Channel Creek, and which would not cost a 20th of the money.

" A Canal has been objected to on the score of expence, and the apparent uselessness thereof, when there is already a magnificent River.—This is not only a short-sighted* objection, which the preceding description of the dangers and difficulties of the Hoogly will completely meet, but in an enquiry of this nature we must descend from the general and the magnificent to the particular and the useful, and we need only state to render it completely striking, that a passage is often made from the Cape of Good Hope to the Pilot in less time than from the Pilot to Calcutta—and also that a Ship may sail from Bombay and anchor off Calcutta in less time than a Ship can go from Calcutta to the Reef-Buoy.—Examples are not wanting where Canals have been made parallel to Rivers to obviate the dangers and obstacles in the navigation of them,† and if ever a case applied, it is to that of the Hoogly where not only the dangers, the difficulties, and the expence of time and money, render it so exceedingly desirable, but where the level of the country and the nature of the soil contribute to make it so perfectly feasible and easy of execution.

" The distance from Kidderpore to Channel Creek, is 40 miles—and in the whole extent requires no Lock except one at each end. The Wet-Dock at the first mentioned place will preclude the expence of one of them, leaving but one Lock Gate to be built, to complete the greatest improvement to the Port of Calcutta ever thought of, the advantages of which we proceed to point out.

" A few prefatory remarks on the entrance into, and exit out of, Channel Creek, must first be made—The entrance of Channel Creek at its junction with the Hoogly is narrow, but with the aid of Steam Boats can be navigated with the most perfect safety and facility at all times by the largest Ships.—The direction of the entrance is West and East, whilst the line of the Hoogly and of the Creek itself along the East Coast of Saugor Island is North and South.—This cross direction to the line of the Hoogly makes a most perfect Harbour, Land-locked on every side, and protected from every wind—it is a singular coincidence that Kidderpore is the only place within ten miles of Calcutta where the River affords a proper situation for the entrance into a Wet-Dock, or Canal, and this is the only one down the River where the same object could be effected. In the Freshes Diamond Harbour might do, but in a strong Southerly or South-west wind, there is no place below Budge-Budge where a Ship could haul into a Dock or Canal—into Channel Creek however, in almost a gale of wind from any quarter a Ship might enter with the assistance of a Steam Boat—for when the sails could not act, she could always with the Steam Boat and tide easily accomplish it.

" In coming up the River in the Freshes, Ships could at once get up to the entrance of the Canal, as the Flood Tides as high as this, are sufficiently powerful during the strongest Fresh to enable them to move even with a contrary wind—and having entered the Canal—they can always in one day go up to the Dock—avoiding the dangers of the River, the loss of anchors, much detention in time, and the greatest part of the expence of Pilotage—and of Row Boats.

" In going out of the River, Ships can in one day go down the Canal from the Dock, and from Mud-Point the difficulty of getting down against the strong Southerly winds is little comparatively, as there is room to work a Ship, whereas higher up, it is owing to the weakness of the Ebb Tides and the wind blowing hard in the contrary direction, that Ships will not drop, and to work them there is no room—which causes the great detention; they will thus save 2 or 3 weeks, avoid the dangers of the James and Mary and other Sands, together with that of the loss of anchors—a great part of the expence of the Pilotage and of Row Boats.

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* See Appendix (H) page xxxi, Paragraph 9, to Municipal Committee's Report.—J. M.

† Note.—In the Hoogly itself, there is a Canal for Boats between the Roopnarain and Tingorocolly Rivers.

" Not only will the dangers, the difficulties, the loss of time, and enormous expences of the Hoogly be obviated by the Canal, but it will equally facilitate the navigation of Channel Creek, which would much benefit the Port of Calcutta, for from the entrance of the Canal, either passage might be chosen according to the winds or season of the year. For instance, during the blowing months of April, May and June, it would be easier getting to Sea under the Lee of Saugor Island, than on the Weather-side of it, where the expanse resembles a Sea—for completing large Ship's cargoes, which could not load wholly in the Dock, it would be decidedly preferable, because the smallest boats could with safety be employed to load them instead of the expensive Sloops at present in use; and for large Ships touching here, such as the Company's Ships going on to China, it would be a most superior Harbour to that of the new Anchorage, both on account of the stillness of the water, and that of the sending to Calcutta through the Canal their Bengal cargoes and getting their China ones on board.

" In Channel Creek, the Flood Tides are not near so strong as in the Hoogly—There are no Bores, and North-westers cannot affect Ships because they would lie protected under the Lee of Saugor Island—Neither are the Freshes so strong, as it is only a lateral branch of the Hoogly and receives no land floods but from it."

No. XLI.

Extract of a Report Dated February 15th 1841, *on the Rajmahl Canal, by the Rajmahl Committee.*

" 2. Believing it to be generally admitted, " that opening and perfecting lines of interior communication," (more especially those leading from Capitals, having by sea, unlimited commercial intercourse,) has ever been found eminently conducive to national improvement, it is deemed unnecessary to offer proof of the assertion, further than by referring to the prosperous state of Britain and America, where such works abound and are multiplying, compared with that of any country, however superior in natural fertility, in which they have continued neglected, or are unknown.

" 3. Bearing in mind that the Ganges receives, in its course through 1,200 miles of the central and infinitely improvable plains it fertilizes, eleven rivers, " several of them equal to the Rhine, few less than the Thames," and that when it has reached the head of the Delta at Rajmahl, its *distance from Calcutta* does not exceed 200 *miles;* and further having in remembrance, that during a great portion of the year, the only *passable* Channel for boats drawing 5 feet water, between the latter *City* (the Capital of India) and the station named, makes a circuit of 528 miles, (this chiefly through the perilous labyrinth of creeks and wood-encumbered straits, forming the wilderness called the Sunderbunds), it will readily be acknowledged, that amongst the good effects of opening a direct line of permanent navigation* between deep water in the Hooghly above Calcutta, and the great River at Rajmahl, there would be the highly important one of its affording the means of conveying safely, cheaply, and speedily to the Ocean outlet, *increased* quantities, and ultimately improved qualities of the agricultural and mineral produce of the entire regions traversed; nor this alone, as by inevitable commercial reciprocation, the same line would immediately serve for supplying these regions with augmented amounts of the sea-borne products or manufactures of other countries."

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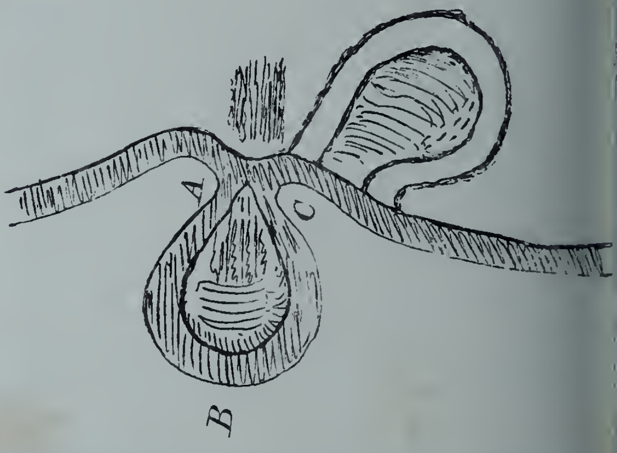
* Also answering for irrigation.

" 28. If an attempt was made to rectify the exceedingly tortuous course of the *Bhaugirruttee River*, between the mouth of the Adji River at Cutwa, and the mouth of the Curree Nullah at Mirzapore, (or the lower end of the Canal in the Hooghly,) by cutting through the narrow necks of the intervening loops or horse-shoe bends, the immediate effect of such rectification would be its laying nearly dry for several months in the year the bed of the *Bhaugirruttee* between the Adji, and the shoals periodically formed in the *former* River near its exit from the Ganges; yet such rectification of the Bhaugirruttee has not infrequently been proposed as the means of *improving* its navigation; and were the Canal levelling sections of no other value, they would be useful in demonstrating that an outlay of money on attempts, by such cuttings, *to improve the communication through the bed of the Bhaugirruttee, could* only terminate in making it (if possible) *worse*.

" 29. The comparatively great difference of level between the Bhaugirruttee at Cutwa, and (its continuation,) the Hooghly at Mirzapore, being in the direct line of its present course at the rate of 7.2652* inches in a mile, also explains the great tortuosity of its intermediate bed, and the cause of its constant shallowness in the dry season; as, running through the soft and sandy alluvial soil of the Delta of the Ganges, (which the Canal does not,) such soil could not possibly bear the abrasion and under-cutting incident to a current of 6 miles per hour, which it at least would be, during the inundation season, if the lower *third* of the course of the Bhaugirruttee were straightened so as to make its fall (what in a direct line it actually is) 7.2652 inches per mile.

" In such a soil, with such a velocity, the Channel, in place of continuing straight, necessarily acquires the serpentine curves, and circumflections, which the accompanying Map of it represents, and which, by reducing the fall, in its crooked course, to 3½ inches per mile, enables the banks, for a time, or until the neck of one of the loops is cut through, to bear the reduced current, but as the immediate effect of this natural rectification is an increase of fall per mile in the bed adjacent,† and consequently a great *local* increase of velocity, it is invariably found that each such event precedes, and occasions, the formation of a similar horse-shoe-bend, pointing in an opposite direction, in the thus ever-changing natural Channel.

† Suppose the bend A, B, C, be 10 miles in length.



And to have a fall from A to B, and B to C, at the rate of 3½ inches in a mile, and that the cut A C being one mile in length, is formed, it is evident that the total fall in this cut of *one mile*, will be 3½ inches × 10=35 inches, or nearly 3 *feet*, and consequently that the velocity of the current passing through it, will be so increased as to produce the effects described.

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* See page 188, of Calculations, also Lieutenant Cunningham's Table of the fall of the Ganges " and Bhaugirruttee," Division 3rd of his Report.

30. As the above description applies generally to the northern *portions* of the Rivers of the Sunderbunds, or to those of the Delta of the Ganges, not directly and powerfully influenced by the tides of the head of the Bay of Bengal, the slightest *inspection* of any tolerable Map, showing the present course of these Rivers to the southward from the Ganges and the numerous intermediate jheels, or stagnant pools, which at one time formed portions of their Channels, will prove that an alluvial region which has been so traversed over by these streams, and which is still as much as ever subject to being again traversed by them, is as badly as possible adapted for the site of a *permanent* line of water communication from the Hooghly above Calcutta to one of the easterly Sunderbund streams leading to the Ganges. Yet within the last few years, the opening* of such a line, crossing by locks and loose brick Dams, large and deep Rivers, constantly liable to the changes that have been adverted to, has been seriously proposed. Nor, so situated and constructed, could there be but two objections to undertaking such a work, the one, that from the nature of the Dams proposed, it would be nearly empty in the dry season; the other, that from the peculiar construction of the locks exhibited, it would in the season of inundation be impassable. The latter objection might apparently have been got rid of by leaving the *locks open* during *this* season, but being useless in the dry months, this would have been tantamount to totally omitting them from the plan, a measure that (as *correctly* affirmed by its inventor) would have led to another extraordinary inconvenience, namely, the speedy filling up of the very deep (and consequently very costly) Channel proposed to be excavated by alluvion thrown into it by the inconstant and ungovernable Rivers crossed. The million-horse power of those Sunderbund Rivers cannot be trifled with, by brick *Dams, &c.* but even had other Dams of solid stone masonry, or such as would have had a chance of resisting the force of their currents, been proposed, it is sufficiently evident, that their only effect would have been to make the streams (as is their habit) form for themselves new and comparatively unobstructed Channels.

31. The Committee appointed in 1831, to Report "whether there be any and what "prospect of keeping the Bhaugirruttee River open, or, of essentially improving the na- "vigation of it by any means at the disposal of Government," after arriving at the conclusion that there *was not,* and that the certain result of forming a cross Channel between one of its upper reaches and the Ganges, would be the early filling up of this Channel by shoals of alluvion, similar to those annually deposited in the Bhaugirruttee itself, recommended the construction of the Rajmahl Canal, or of the one immediately under consideration, expressly, on the ground that "no cut running nearly east and west, therefore "generally at right angles to the main discharging branches of the Ganges, will ever "be found permanently favourable for navigation."

This Committee consisted of Colonel McLeod and of Captain Forbes (Engineers), and of John S. May, Superintendent of the Nuddea Rivers; and bearing in mind that the party last named was one of those who, on the grounds alluded to, and on *others* stated in the Report, joined in urging on the attention of Government the superior facilities for permanent navigation that would be afforded by the Rajmahl line, it appears inexplicable how he could subsequently have fallen under the delusions which led to his proposing the line from the Hooghly to the Goroy, referred to in the preceding 30th paragraph; and which, running nearly "east and west across some of the main discharging branches of the Ganges," and being in consequence liable to the impracticabilities pointed out, would certainly be as unfavorable for " permanent navigation," as could well be imagined.

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* Referring to Colonel A. Galloway's proposed Canal from Maugrah to the Hoogly, Estimated by J. P. May, Esq., Superintendent of Nuddea Rivers, to cost Rupees 36 Lacs.

See Military Board's Proceedings, 24th January 1833, Nos. 34, 35, 37, and 38.
Ditto, ditto, 27th September 1835, No. 27.
Ditto, ditto, 3rd May 1839, Nos. 45, to No. 48½.—J. M.

We also may state, that the line having thus been formed, it will diminish the navigable distance from Calcutta to Rajmahl for the River Steamers,* during the large portion of the year they are now obliged to pass round by the Sunderbund Channels, 326 miles.† It may moreover be noted that, as during the same period the same distance of 326 miles would be saved to nearly all the vessels and country craft employed in carrying passengers, produce, manufactures, military stores, troops, treasure, &c., between Calcutta and the Ganges, the effect, as concerns expeditious transit, of opening such a line, would in some measure be tantamount to that which would proceed from providing each and all of the descriptions of craft referred to with Steam Engine power.

[*] The reason assigned for not admitting Steamers into the Calcutta Canals is, that they would injure the banks of any Canal not faced with masonry, and would necessitate the Canals being cleared of Boats when the Steamers were about to pass through.—J. M.

[†] The distance by the Sunderbund Channel is 528 miles, while that, 72½ miles by the Hooghly and 129½ by the Canal, only amounts to 202 miles, and 528–202=326 miles.

FINIS.

Bishop's College Press :—Calcutta.